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PRINCIPLES OF SURGICAL PRACTICE

SAFETY FACTORS IN SURGERY OF THE BILIARY TRACT

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INTRODUCTION

SURGERY of the biliary tract has been largely developed in the twentieth century. With the perfection of roentgenographic diagnosis, the increasing knowledge of the physiology and pathological physiology of the biliary tract, and the number of laboratory aids, operations on the gall bladder and its ducts have become not only common but safer. Fortified with the added knowledge, surgeons undertake procedures of great magnitude today, for example, partial pancreaticoduodenectomy, as developed by Whipple (43).

However, one still hears of "liver deaths" and of the unreliability of certain tests heretofore considered dependable. There is still evidence that surgeons are not satisfied with the final results in biliary-tract disease. There is a desire to stress those factors which will make such surgery safer and more lastingly satisfactory to both physician and patient. Heuer (19), in a group of over 35,000 cases of biliary-tract surgery collected from American and foreign literature, gives the following incidence of factors leading to death: gangrene and perforation 10 per cent; operative shock and peritonitis 33 per cent; pulmonary complications 20 per cent; cardiorenal complications 12 per cent, "liver deaths" 4 per cent; pancreatitis 2 per cent; miscellaneous or unknown causes 19 per cent.

With increasing experience, one is more and more impressed with the importance of (1) evaluation of the patient's status by complete clinical and laboratory studies; (2) definite indications for or against operation; (3) the necessity of choosing the procedure best suited to the individual case; (4) the great value of pre-operative preparation, particularly in regard to improvement of liver function; and, finally, (5) the avoidance of injury to normal and/or anomalous ducts or vessels. Only by incessant attention to details can maximum success be assured.

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GENERAL CONSIDERATIONS

The surgeon seldom sees the patient suffering from biliary ailments until the disease is well advanced. The physician, though he may have reason to suspect biliary-tract pathology may wait until his patient has a recurrence or exacerbation of symptoms before recommending surgical opinion. The dangers of operation are greatly increased under these conditions. The liver will often be more or less damaged, although authorities disagree as to whether this liver damage is a cause, a result, or an integral part of the biliary-tract condition. One of the cardinal rules for safer surgery is to see the patient early in the disease.

The question of liver damage and the preoperative preparation or rehabilitation is especially important. It is unwise to send a patient to the hospital one day and operate on him the next. This is true particularly if there be jaundice, dehydration, acidosis, toxemia, and disturbed liver function due to associated hepatitis.

Judd (26) states that biliary calculi in themselves have no effect on the prospect of cure, providing the acute or chronic process receives attention before complications arise. It is unknown whether or not the formation of biliary calculi is a factor in the production of malignancy, but the

two conditions are associated often enough to justify recommending the prompt removal of biliary calculi when found. Calculi are frequently responsible for necrosis of the gall bladder or cystic duct, obstruction of the biliary channels, formation of abscess or fistula, and other serious complications.

The presence of jaundice increases the risk and difficulties of biliary surgery. Hubley is quoted by Hoke (23) as pointing out that the chief dangers of operating upon jaundiced patients are hemorrhage, uremia, hepatic insufficiency, and disturbance of the acid-base balance. He emphasizes the necessity of taking a careful history with reference to familial tendencies toward jaundice and hemorrhage. A careful physical examination will help avoid many pitfalls. Evaluation of the cardiovascular and respiratory systems and study of the fluid intake and output, as well as of the bleeding and coagulation time, are also useful and important; the icterus index and liver-function tests provide invaluable information.

Hoke states that in gall-bladder surgery unsatisfactory results occur at times because of poor judgment on the part of the surgeon as to the degree of the disease present, or as to the patient's ability to withstand the particular operation contemplated. The relatively frequent association of comparatively symptomless cholelithiasis with hepatitis and with malignancy of the gall bladder may justify cholecystectomy even in the absence of marked symptoms.

Boyd (5) made a study of the mortality risks incurred by patients undergoing gall-bladder surgery. Of 1,018 cases in which gall-bladder surgery was done at the Massachusetts Memorial Hospital of the Boston University School of Medicine, 107 were fatal. From the study of these 107 cases Boyd concluded:

The procedures of cholecystectomy and cholecystotomy must still be considered serious operations, with potentialities for a high mortality rate. Appendectomy done at the same time is unlikely to increase the operative risk if the cases are properly selected. Gall bladder operations combined with any other major procedure carry too great a hazard to justify them except in distinct emergencies. In cases presenting multiple surgical diseases a 2 stage operation should be done, the more urgent conditions being treated at the first operation, and the less urgent conditions two or more weeks later.

Women are better operative risks than men. In this series there was a higher incidence of operations and a lower mortality rate among females. Gall bladder surgery in those over 60 carries a mortality rate of from 25 to 40 per cent, increasing with age. In this age group particularly, the severity of symptoms must be weighed carefully before incurring the risks of surgery. Elective operations must be deferred until the patient's general condition has been brought to its optimum.

By exercising the following steps the mortality rate was lowered from 12.2 per cent in 1924 to 6.5 per cent in 1933:

The indications for operation must be specific; stones and a history of colic or of extra-hepatic jaundice are the more important. A clinical history of colic plus positive cholecystograms is always an indication. The operative procedures must be simple, gentle, and not unduly prolonged.

Colp (8) emphasizes that if certain relationships exist between the choledochus, the duct of Wirsung, and the papilla of Vater, both ducts may be converted into a single continuous channel by obstruction of the papilla. Once a channel has been established, bile may flow into the duct of Wirsung, or pancreatic juice may find its way into the choledochus. The varying intraductal pressure is probably the factor which determines the direction of the flow. Reflux of pancreatic juice into the biliary system probably has no appreciable clinical result, but pancreatic ferment sufficiently concentrated in gall-bladder bile to change its usual acid reaction to alkaline may enable the bile salts to act destructively on the wall of the gall bladder, and the activated pancreatic ferment may have a similar action on the wall. As a result of the chemical inflammation caused by these various factors, either an acute cholecystitis or non-perforative peritonitis may occur.

Modern accuracy in the diagnosis of biliary-tract disease and well defined therapy, leave little excuse at present for removing the gall bladder as a routine measure. It is likewise inadvisable to delay operation until the inflammatory or obstructive factor has extended beyond the original site into the ducts, liver, and pancreas, so that when surgery is unavoidable it will carry with it a high mortality and morbidity (Whipple 42). In presenting his views on therapy Whipple emphasizes three factors which enter into the pathogenesis of all cases of biliary-tract disease requiring surgical intervention: (1) gall-stone formation, the result of disturbed metabolism; (2) infection; and (3) obstruction. Singly or in combination, these three are always present and the part of the biliary tract where they are active determines the symptoms and physical signs. An understanding of these factors and their presence in the gall bladder or ducts makes the pathology, symptomatology, diagnosis, and treatment of the disease rational, interesting, and accurate.

If the signs of acute cholecystitis do not subside within from twenty-four to forty-eight hours under a regime of rest in bed, nothing should be given by mouth except hot water and tea and an ice-bag should be applied to the right upper quadrant; then the gall bladder should be removed or drained. To operate in an acute cholecystitis may

be regarded as radical by many but it is Whipple's opinion that the relatively high mortality in his series of cases was due to the earlier policy of delaying surgery until an empyema or cholangitis had made operation imperative. For the chronic cases operation may be delayed while the patient subsists on a diet which excludes foods rich in lipoids and nucleoprotein with a high cholesterol content. He must be cautioned against overfatigue. However, if there be strong evidence of stone formation or cholesterosis, then cholecystectomy carries only a low risk, with permanent cure in most of the cases if it is done while the lesion is still limited to the gall bladder.

DIAGNOSTIC PROBLEMS IN BILIARY SURGERY

A correct diagnosis is always of paramount importance in the prognosis and may indicate special features in the pre-operative, operative, and postoperative management. Meyer and Steigmann (30) in discussing the differential diagnosis of stone or benign stricture as against malignancy of the gall bladder, common duct, hepatic duct, or pancreas, or metastatic malignancy (periportal glands, stomach, ovary), give this table[1]:

TABLE I.—DIAGNOSIS OF BENIGN VS. MALIGNANT BILIARY TRACT DISEASE

Finding	Malignant group per cent	Benign group per cent
	(62 "surgical jaundice cases")	
1. General appearance	apathetic	alert and complaining
2. History of sepsis (fever and chills)	3	32
3. Enlarged liver	82	68
4. Icterus	slowly mounting on high level	variable
5. Icterus index over 100	75	21
6. Loss of weight	65	18
7. No urobilin in urine	76	7
8. Acholic stools	76	7
9. Direct Van den Bergh positive	83	21
10. Low galactose excretion in urine, less than 3 gm.	92	80
more than 3 gm	1.6	4.8
11. Ascending or maintained sugar-tolerance curve	73	25
12. Morphine required for pain	0	50
13. Pruritus	41	21
14. Plasma cholesterol[2] above 200 mgm./100 c.cm.	53	50
170–200 mgm./100 c.cm	30	8

[1]Modified by the author.
[2]Lower values are obtained in hepatosis jaundice.
Character of jaundice: the jaundice in malignancy tends toward greenish yellow, in hepatosis (severe) toward reddish brown.

Jacobi (24) aptly points out that the difficulties in clinical studies of jaundice are usually due to lack of appreciation of the underlying mechanisms. Jaundice, for clinical purposes, is divided into: (1) retention jaundice and (2) resorptive (regurgitative) jaundice:

Retention jaundice indicates an increase in the circulating bilirubin from causes other than obstruction of the common duct or intrinsic lesions of the liver. Retention jaundice is classified as follows:

1. Jaundice associated with hemolysis of the red blood cells: (a) hemolytic jaundice; (b) pernicious anemia; (c) splenomegalic hemolytic anemia; (d) sickle-cell anemia; (e) acute infectious disease associated with increased red blood-cell destruction; (f) icterus neonatorum; (g) infarction; and (h) Weil's disease.

2. Jaundice associated with an anoxemia of the liver cells: (a) cardiac decompensation; (b) toxic hepatitis resulting from the toxic action of such drugs as arsphenamine, chloroform, and phosphorus, or from hematogenous infections; and (c) anoxemia due to the occurrence of pulmonary infarctions.

In retention jaundice an increased amount of bilirubin is being brought to the liver cells which cannot excrete it all because of the increased amount and/or damage to the liver cells. Briefly the laboratory findings in this type of jaundice are:

1. This type (hemolytic) of bilirubin[3] is bound to plasma proteins and does *not* appear in the urine.
2. The bile salts do *not* appear in the urine.
3. Urobilin *does* appear in the urine.
4. Urobilin is increased in the feces.
5. The Van den Bergh reaction is either indirect, delayed direct, or both (combined).

Resorptive jaundice. In resorptive jaundice (regurgitant jaundice) the bile is excreted by the liver cells but it succeeds in reëntering the blood vessels of the liver and thence gets into the blood stream. Under this heading may be included the following types of cases:

1. Obstructive jaundice: (a) calculus in common duct or ampulla of Vater; (b) stricture of the common duct; (c) marked suppuration of the common duct; (d) carcinoma of the common duct; and (e) extrinsic pressure from glands, scar tissue, or carcinoma of the head of the pancreas.

2. Intrinsic hepatic disease: (a) cirrhosis of the liver; (b) carcinomatous involvement of the liver; and (c) abscess of the liver.

3. Toxic liver damage.

[3]1–10,000 concentration in the blood is the threshold for kidney excretion.

Briefly, the clinical and laboratory features in resorptive or regurgitation jaundice are:

1. Pruritus.

2. The bilirubin[1] and bile salts quickly appear in the urine.

3. Urobilin in the urine and feces is decreased or absent.

4. The Van den Bergh reaction is the immediate direct.

5. In complete obstruction clay-color stools persist.

However, in toxic or hemolytic jaundice an element of obstruction with rupture of the bile canaliculi can be superimposed, which gives a combined lesion which constitutes a clinical snag preventing diagnostic differentiation into obstructive and non-obstructive forms. Moreover, the various liver-function tests only indicate a degree of functional impairment and do not differentiate obstruction from non-obstruction:

1. *Bromsulfalein test:* Intravenous administration of bromsulfalein should normally yield no dye in the blood stream at the end of half an hour; the test is valuable in toxic forms of jaundice; in cirrhosis and carcinoma the results are variable.

2. *Levulose test:* Levulose by mouth is normally rapidly stored in the liver; 40 gm. of levulose are fed by mouth and the blood sugar is noted for several hours. In diffuse liver damage the blood-sugar curve is very high, with the peak at one hour and a half.

3. *Galactose test:* Forty grams of galactose by mouth should yield a spill no greater than 1 gm. into the urine, and the blood-sugar rise should be no greater than 30 mgm.

4. *Hippuric-acid test* (Quick): Six and nine-tenths grams of benzoic acid by mouth should be conjugated by the liver so that a minimum yield of 3 gm. appears in the urine in the prescribed time, four hours, as hippuric acid.

5. *Fibrinogen test* (Geill): Plasma or serum fibrinogen values of ½ per cent or less indicate hepatic disease, acute yellow atrophy, cirrhosis, or extensive liver metastases; in the presence of jaundice, values over ½ per cent indicate disturbance of the biliary tract, stasis, and possible lithiasis.

6. *Dextrose-tolerance test:* Jacobi found that 100 gm. of glucose administered by mouth in a case of jaundice which gave a return of blood sugar to normal at the end of two hours indicated a toxic jaundice in which operation was of no use and contraindicated; should the blood sugar fail to return to normal at the two-hour period, stricture, suppuration, calculus, or carcinoma of the head of the pancreas are to be suspected; this is the so-called obstructive type of sugar-tolerance curve. However, intrinsic liver disease gives the same curve (cirrhosis, carcinoma, or abscess of the liver). To differentiate benign cirrhosis of the liver or mild toxic hepatitis from the other conditions, the patient should be fed 250 gm. of glucose daily, and receive 10 units of insulin twice a day and an ampule of liver extract daily (Vitamin-B deficiency). With this regimen for two or three weeks cirrhosis or mildly toxic cases clear; failure to clear indicates choledocholithiasis, carcinoma of the common duct, carcinoma of the head of the pancreas, or other obstructive condition.

7. "*Stercobilin-tolerance test*" (Watson, 41): Fifty milligrams of crystalline stercobilin given intravenously (urobilin) should be destroyed by the liver. In hepatic dysfunction 25 mgm. or more are excreted by the kidney into the urine (lowered stercobilin tolerance).

While jaundice is an indicator of disease of the liver or biliary tract, its absence does not rule out serious organic disease. Thus, Chaikin (7) has recently reported a case of carcinoma of the head of the pancreas with metastases to the liver without jaundice and quotes the following incidence of jaundice in carcinoma of the head of the pancreas:

Musser	41 per cent—90 cases
Eusterman	46 per cent—48 cases
Friedenwald	78 per cent—37 cases

According to Meyer and Steigmann, the jaundiced patient requires a thorough physical examination which should include a search for possible lymph-node metastasis, scars from previous operations, masses in the abdomen, rectum, or pelvis, and a determination of the size of the liver, spleen, gall bladder, and kidney. Cases that give persistent negative urobilin tests in the stool and urine for from ten to fourteen consecutive days are strongly suggestive of a surgical jaundice of the malignant type. The authors have reason to believe that in the presence of jaundice the liver does not excrete the dye used in the Graham-Cole tests, so that this test, at least as done at present, is almost useless. This opinion is based on experimental findings of the junior author, and is in accordance with the findings of numerous other workers in this field. The laboratory tests must be done accurately; they must be correctly evaluated and they must not be regarded as pathognomonic. It is in the evaluation of all the data obtained that one's clinical judgment is of importance. No single type of icterus is the sole problem in any case.

[1] 1–50,000 concentration in the blood is the threshold for kidney excretion.

Surgery appears to be indicated in jaundiced patients who present themselves with an icterus of variable or increasing intensity, especially if associated with a greenish hue, pruritus, and dermatitis; who give a history suggestive of a previous biliary or gastro-intestinal disease; who are in late middle life or older; and who have had no exposure to hepatotoxic substances or a systemic disease. The indication is especially clear when these patients have an enlarged liver, a palpable gall bladder, other palpable abdominal masses, palpable lymph glands, loss of weight, and absence of a palpable spleen.

The importance of early recognition of surgical jaundice is demonstrated by the fact that many patients who have biliary colic and intermittent attacks of slight icterus go on to severe liver damage if relief is not obtained through surgery. Given the diagnostic data considered, the authors do not hesitate to advise surgical relief of the jaundice after careful pre-operative preparation of the patient.

Age of patient. Gall-bladder disease is usually looked upon as a disease associated with obesity and middle life, the period when affections of the heart, the vascular system, and the kidneys are most likely to make their appearance. Whether these degenerative diseases exist quite apart from the pathological condition in the biliary tract, or whether they are all part and parcel of a state due to one underlying cause is difficult to estimate. The coexistence of cardiovascular and renal disease greatly increases the danger of surgical intervention upon the biliary tract, and it is only by dealing appropriately with these complications that we can hope to make biliary surgery safer.

By no means is gall-bladder surgery done only upon those of middle age. Many persons are well advanced in years and these elderly patients present problems which do not crop up with younger subjects. Boyce (4) notes especially that all upper abdominal surgery is likely to be complicated by respiratory-tract disturbances, particularly in middle and later life, biliary surgery being no exception. To this must be added the risks of hemorrhage, shock, and infection. Yet, with proper precautions, even the aged and enfeebled can be carried through safely, as many operators have testified.

Judd has stated that many of the patients seen at the Mayo Clinic have been between seventy and eighty years of age, "but even under these circumstances, careful pre-operative preparation often will enable an aged and extremely debilitated person to tolerate the extensive operation that usually is required." He cites the case of a woman of seventy-four who had lost 50 lb. in weight, yet recovered perfectly from "cholecystectomy, choledocholithotomy and choledochostomy" performed at a single session. Babcock says that though the third stage of complicated biliary disease usually manifests itself after the age of forty-five years, the complication may occur in those under the age of twenty, "as in a case in which we found cholecystitis with over 300 gall stones, associated with an acute pancreatitis in a girl of 13 years." The records show, in fact, that patients operated upon at the extremes of life, on the whole, do better than those who are in the classic "gall-stone period."

Stage of the disease. In general, the earlier the operation is performed the better will be the patient's chance of recovery and complete cure. If the gall bladder is merely infected even when stones are present, the case presents a fairly simple surgical problem. However, if the condition has already progressed to the stage of obstructive jaundice, or a secondary inflammation has been set up in the pancreas, the risks are enormously increased. However, the difficulties which stand in the way of getting patients promptly to the surgeon usually prevent the safety factor of early operation from being introduced. The operator must then decide how he can best deal with the disease in the stage in which he first sees it and this is seldom an easy decision to make. Careful estimation of the patient's ability to withstand operation is of utmost importance and a sufficient number of pertinent tests of functional ability of the organs likely to be affected is indicated.

In the experience of Walters (39, 40) and his coworkers, the presence of jaundice causes a rise in the operative mortality rate, for it indicates biliary obstruction with its associated infection within the liver and the resulting disturbances of hepatic function. Generally, such complications could have been avoided if the diseased gall bladder has been removed before it discharged its stones into the common bile duct. Cholecystectomy, if performed early, would prevent the benign biliary obstruction due to inflammatory edema in the head of the pancreas and cholangitis, in almost all cases the results of failure to remove the infected gall bladder.

Patients with intermittent hepatic fever due to choledocholithiasis may have to be operated on during the febrile stage in order to relieve biliary obstruction and to establish drainage at the earliest possible time and thus avoid hepatic damage. Recovery in some cases has been ma-

terially aided by the administration of oxygen subsequent to operation.

Evaluation of laboratory aids. It is Lahey's (27, 28) opinion that no test of biliary function can be relied upon except in careful correlation with the clinical findings, an opinion which he has founded upon an exceptionally wide experience in the management of biliary-tract disease. While the Graham test is a valuable diagnostic procedure in the detection of biliary disease, it is correct only in from 80 to 90 per cent of the cases. If Lahey finds the Graham test by mouth uncertain when correlated with the previous clinical findings, he repeats it, using the intravenous technique. However, he does not give intravenous tests to "patients who have angina pectoris, to patients who have any serious cardiac lesions, to patients who are badly emaciated or in bad condition," nor to those who are jaundiced or whose gall bladders are in the acute stage of inflammation. This is because "the introduction of the dye into the blood stream in the presence of an acutely infected gall bladder may make it an acute gall bladder, requiring immediate operation."

Lahey "would not consider operating on a patient merely because his gall bladder did not fill or empty, if he had no clinical evidence of gall bladder disease." Neither would he "hesitate to operate upon a patient for gall stones if he had typical gall-stone colic and his gall bladder emptied and filled normally, as will occasionally be the case." He believes very strongly that "when the clinical evidence of gall bladder disease correlates with the x-ray findings after administration of the dye, then it becomes of great value and it adds to one's feeling of security in advocating surgery for probable gall bladder pathology." It is much safer, in his opinion, when presented with a case of acute cholecystitis, to "temporize" by doing a preliminary cholecystostomy and reserving cholecystectomy for a later date. However, in order to save the patient from undergoing two operations, he endeavors to "tide him through the acute cholecystitis, if the progress of the case is satisfactory, until the time when the complete removal of the gall bladder can be safely done."

Although such a course increases the safety in certain conditions, it requires the best surgical judgment to decide when it is safe to follow it. Only when the previously high temperature has begun to fall, the tenderness is tending toward localization, spasm is disappearing, and the general reaction is favorable is it safe to wait. If, on the other hand, tenderness persists, temperature remains high, the white blood-cell count shows no decrease, or no general improvement is discernible, preliminary drainage with cholecystectomy at the end of one or two months is the only safe course.

In the discussion of safety factors in gall-stone operations, Graham (17) himself has said that the study of certain cases in which death followed a relatively simple cholecystectomy showed that in every instance there had been an abnormally high retention of the dye when his test had been applied pre-operatively. The deaths occurred in patients who had apparently been good risks for operation, and at autopsy no cause for death other than a badly damaged liver was in evidence. In reviewing the entire case history, he found that in every instance there had been a high retention of the dye. "Whereas in the normal individual there is a retention of from 10 to 15 per cent of the dye within a half hour, of these four cases just mentioned two had retentions of 90 per cent, in the half hour, one of 70 per cent and the fourth of 60 per cent. . . . In view of the striking relationship . . . between a high retention of the dye and the danger of death from operation on the biliary tract, we decided that in the future we would not operate upon patients who showed a high retention of the dye." Therefore, given a dye retention of over 35 per cent, Graham believes operation should be postponed until dietary and other measures have reduced these figures.

It appears that one can no longer be content with the mere qualitative detection of urobilin in the urine and sterobilin in the feces. Watson (41) has lately found that a quantitative estimate[1] of stercobilin (urobilinogen) in specimens of urine and feces collected over a period of from one to four days is of great value in the differential diagnosis of possible lesions in the biliary tract. He has also obtained valuable information from the so-called "stercobilin tolerance" test, in which stercobilin is injected intravenously.

Among the less generally used tests of hepatic function are the estimates of phosphatase in the blood and tyrosine in the urine; the latter test is more apt to be positive in marked degenerative states of the liver.

A word should be said concerning the syndrome of gonococcic perihepatitis in young women with gonorrheal infection of the cervix and pelvic viscera. This syndrome, described by Curtis (10), Hinton (22), and Fitz-Hugh (14), will not rarely confound the diagnosis. At laparotomy, the diagnosis will at once become evident by the delicate "violin-string" adhesions between the

[1]Normal values for daily excretion; urine, 1 to 5 mgm., feces, 50 to 200 mgm.

liver and diaphragm; the abdomen should be closed forthwith and with pardonable embarrassment and chagrin.

When all is said and done, after all supplemental aids are considered a general estimate of the situation is made by the surgeon, and his common sense, good judgment, and valuable clinical experience are still of tremendous importance in the management of the case in hand.

Pre-Operative Factors

In everyday practice one cannot make a selection as this would mean denial of surgical benefits to a large percentage of patients. The only alternative is to institute pre-operative therapy designed to remedy, so far as is possible, the injuries previously sustained by the liver, and defer operation until the patient's condition is sufficiently improved to make the risk small enough to warrant its being undertaken.

It has been recommended by Hewitt (20) that because "for many years it has been recognized that the depletion of glycogen, stored in the liver, definitely reduces its functional efficiency, and that the administration of carbohydrates and the building up of the glycogen store of the liver hasten repair of liver damage," an excellent safety factor would be to check liver function again after glucose and saline administration. Only when the response to this therapy showed an approximation to normal conditions would it be safe to undertake operation.

One feature of the ordinary case of obstructive biliary disease is the incomplete digestion and absorption of fats and the loss of the bile salts which are excreted in the urine. The normal circulation of these salts between the liver and the intestine is disorganized and depleted by the constant drawing off of these salts into the urinary tract. Because the body is not getting its quota of fatty acid, it is forced to deplete its carbohydrate and amino-acids reserves.

Correction of these conditions may be made by a system of substitution therapy such as is recommended by R. Douglas Wright (44) of Melbourne, Australia. There must be "administration of fat and bile in a form which will be liberated in the presence of pancreatic juice and in a quantity sufficient to have a therapeutic effect. The first requisite is obtained by coating the bile with salol (its bitter taste and irritant action on the stomach preclude its being given otherwise). The normally secreted 30 grammes (500 grains) of bile solids per day is too much to give conveniently." Forty-eight pills of 0.3 gm. (5 gr.) were given to 1 patient whose case is used for illustrative purposes. The diet was carbohydrate 150 gm., fat 100 gm., and protein 70 gm. He adds: "A very definite improvement in fat absorption and metabolism at once became manifest."

Such a regimen may be of great assistance in restoring the carbohydrate and fat metabolism to normal and is an added factor of safety from the anesthetic risk by preventing acidosis. It should be emphasized, however, that these dietetic measures cannot usually be substituted for the administration of glucose, saline solution, calcium chloride, and Vitamin K.

It has been stated by Crile (9) that "with a low vitamin diet, especially one that lacks the fat-soluble vitamins A and D, gall stones are more apt to occur. If a diet high in these vitamins, that is, one containing leafy foods and cod liver oil, or other fish oils, is used, gall stones disappear more rapidly in animals, whether the stones were placed in the biliary tract, or were produced by avitaminosis."

Johnson, Ravdin, and their coworkers (24a), in a study of the effect of diet on the composition of the liver in the presence of obstruction of the common bile duct, have found that a diet with high carbohydrate, high protein, and *no fat* spares liver protein. The regeneration of the liver cells requires an adequate protein intake. Three hundred cubic centimeters of 5 per cent glucose yields only 600 calories and is only $\frac{1}{3}$ of the daily basal requirement. Therefore, carbohydrate and protein should be given liberally by mouth whenever possible. Carbohydrates displace liver fat and spare liver protein; this regimen protects the liver from toxic substances such as volatile anesthetics. A high glycogen liver content protects the liver against fatty degeneration and a low liver glycogen tends to be associated with a high fatty content and destruction of liver protein.

Altshuler and his coworkers (1) used a sterile mixture of amino-acids, which are a hydrolysate of casein, to which was added 1.8 per cent tryptophan, 1.5 per cent cystine with 5 per cent glucose and .7 per cent sodium chloride. This is a clear amber fluid with a content of 7 gm. of amino-acid nitrogen per 100 c.cm. This fluid is mixed with an equal amount of sterile water. It is administered either intravenously or subcutaneously, 1,000 c.cm. being injected over a period of from four to five hours. It is well tolerated and almost completely utilized. Since peptones and higher fractions of the protein molecule are not well tolerated by the body, the method of Altshuler and his coworkers represents a step forward in the maintenance of protein equilibrium

when protein administration is of urgent importance.

Of course, whole blood, plasma, and serum at present still afford the most rapid means of protein administration.

An adequate pre-operative supply of Vitamin K and bile salts for the correction of prothrombin deficiency and the prevention of hemorrhage is of much greater immediate importance. Ansbacher and Fernholz (2), Andrus and Lord (1a), and others have successfully used the synthetic product 2 methyl 1-4 napthaquinone in place of Vitamin K.

All writers stress the importance of maintaining normal salt and water balance and of making frequent sodium-chloride and hematocrit determinations. Should the blood chlorides fall below normal, intravenous injections of normal saline solution are advisable. Accurate records of fluid intake and output are essential, with allowance also for fluid lost in the expired air and through sweating and insensible perspiration.

Ravdin (32) quotes Waltman Walters as calling attention to the importance of operating on severely jaundiced patients when the level of the bile-pigment retention in the blood is more or less stationary. The patient operated upon when the Van den Bergh reaction shows a constant level of the serum bilirubin is better able to withstand the additional trauma of operation than is the patient who is operated on in the face of a rapidly rising bile-pigment concentration in the blood.

Since carbohydrates are the major source of liver glycogen, some attempt should be made to increase the carbohydrate intake prior to operation. This may in part be accomplished by high carbohydrate feeding by mouth, reinforced by the intravenous administration of glucose. It must be remembered, however, that even though the glycogen store is temporarily replenished, it is again rapidly depleted by the very factors which initiated the process in the beginning—ductal obstruction. The glucose given pre-operatively should be administered very slowly since the sugar tolerance is greatly reduced. From 50 to 100 gm. of glucose introduced in from ten to twenty minutes will let fully half spill over into the urine within a short time. It has been Ravdin's experience that spill into the urine will not occur if not more than 20 gm. per hour are given intravenously to the average-sized adult.

Ravdin and his coworkers (33–36) believe it best to prepare every patient as though he were at least a potential bleeder. There is no reason for using calcium solutions for there is usually no calcium deficiency in obstructive jaundice. Every patient should be given a high carbohydrate diet by mouth and this may be re-inforced by the daily intravenous administration of glucose. Ravdin gives his jaundiced patients a transfusion several times before operation, and should hemorrhage occur postoperatively, transfusion is again resorted to. The author has transfused a patient 22 times before the bleeding tendency was brought under control. The frequency of transfusion and the amount of blood used must be determined for each patient, but it is far better to use too much blood than too little.

Anesthesia

The choice of an anesthetic is in most instances one of personal preference. Hewitt condemns spinal anesthesia, saying that while it does not bring additional trauma to the liver, it "is not always satisfactory and is not without danger." Lahey, on the other hand, declares that "in the particular situation where there is an infection in the liver, provided the spinal anesthesia can be given by men who are qualified to employ it and meet its emergency, it is nearly ideal . . . but it must be given by experts and it must not be given to the bad risk cases." For the "bad risks" he recommends ethylene combined with regional anesthesia.

Nitrous-oxide gas in combination with local infiltration and, if needed, small quantities of ether, is the choice of some surgeons. Crile's views on this method are well known, and the low incidence of fatal outcomes in clinics where this form of anesthesia is used as a routine would seem to be conclusive evidence that combined methods of anesthesia may be included among the safety factors in biliary-tract surgery.

Factors which have contributed to a reduction in the morbidity of biliary-tract operations in Ravdin's hands, giving greater safety to bad risk patients, are: spinal anesthesia, if preceded by the administration of ephedrine as suggested by Ferguson and North (*Surg., Gynec. & Obst.*, 1932, 52: 621), not exceeding 150 mgm. of novocaine, to avoid an alarming fall in the blood pressure. Contrary to general opinion, he believes, nitrous-oxide and oxygen anesthesia is not safe in the jaundiced patient. The increased anoxemia which this anesthetic induces in the liver cells may prove of serious consequences, because of its producing further liver degeneration and necrosis. On the other hand, cyclopropane, which permits the use of a high concentration of oxygen, may prove to be a very safe anesthetic in these cases. If ether is used it must be with a plentiful supply of oxygen. Ravdin has shown that the volatilization of an

anesthetic such as chloroform with oxygen is just as effective in preventing liver necrosis as is a high carbohydrate diet for several days prior to anesthetization.

Postoperative pulmonary complications are notoriously high in surgery of the biliary tract. Therefore, meticulous precautions should be taken to maintain the warmth of the patient, to insure adequate ventilation of the lungs, to prevent emesis, and to insure freedom of the trachea and bronchi from secretions.

Factors During Operation

It is the consensus of opinion among most experienced biliary-tract surgeons that early operation is advisable. Palmer (31) says, "The first and largest factor in biliary deaths is the delayed operation which permits of a train of physiological changes that occur with time's passing." He protests against "combined operations for complicating and accessory pathology," and also laments the "insufficient supportive treatment immediately before and after operation to overcome the handicaps of coexisting pathology."

The trials and tribulations of both patient and surgeon in some cases are only too well known to require much comment.

Erdmann (13) tells of a patient who had been operated upon three times before coming under his care. At the time he first saw her she had a fistula and marked jaundice. The first intervention had been a cholecystectomy and the two that followed had evidently not been complete procedures. At his first attempt Erdmann followed the Lahey method but, "after a supposed establishment of a well lined fistula the sinus closed. Her fifth operation and my second was a success—a hepaticoduodenal anastomosis was done."

Hawkins (18) is of the opinion that too many gall-bladder operations are done in unnecessary haste and he urges more attention to pre-operative preparation: "forty-eight hour pre-operative regimen of a high carbohydrate diet and glucose intravenously is a crutch to the liver which will be greatly appreciated by the surgeon postoperatively. It is extremely rare that gall bladder disease demands emergency operative measures and undoubtedly the mortality from cholecystectomy would be appreciably lowered if none but the most extreme were ever viewed in the light of emergency cases." However, if operation could be undertaken earlier in the course of the disease, the necessity of intervention in acute conditions could be avoided. Practically all surgeons advise against operating upon very acute cases; but despite these warnings, the emergency cases still come for relief.

In discussing "liver deaths", Heyd (21) brings forward as an argument in favor of early operation that "by earlier operation some of these patients would have been cured by preventing the development of malignancy . . . All of them had gall stones and gave a history of long continued gall bladder disease." He says that earlier intervention would have obviated these deaths.

Anomalies (Figs. 1 and 2). The operator who seeks to surround his patient with every safeguard should be thoroughly familiar with the anatomy of the region before undertaking any operation upon the biliary tract. McWhorter (29), a number of years ago, found in 46 cadavers that the cystic artery or its parent trunk passed posteriorly to the bile ducts 19 times and anteriorly 16 times, while in the remaining 11 subjects the relations were sufficiently unusual to be classed as "anomalies." He is convinced that the varying relations of the cystic artery with the frequent occurrence of a double artery (he found the cystic artery doubled in 6 or 13 per cent of his 46 cadavers) and inconstancy of the relations of the hepatic branches contributed to the frequency of hemorrhage at operation. Babcock, however, attributes such hemorrhage to the relatively high internal pressure in the arterial branches because they are so close to the aorta and suggests special care in the ligation of the cystic artery. "It should be tied with care, preferably with silk which is not so liable to slip from a small vessel as is catgut."

Sandrini (37) states that anomalies of the biliary tract occur with sufficient frequency to be of clinical significance. He reports a case of a twenty-two-year-old soldier wounded in the right hypogastric lumbar regions. Operation showed an injury of the liver and kidney and a hematoma of the gall bladder. The right hepatic duct entered the cystic duct at the neck of the gall bladder and the left hepatic duct entered the cystic duct a little lower to form the common bile duct. He cites observers who have reported complete absence of the gall bladder and a case in which the gall bladder resembled the appendix. The most frequent anomaly is a lateral implantation of the cystic duct into the neck of the gall bladder so that a diverticulum is formed at the lower end of the ampulla. Other rather frequent anomalies are cases in which the cystic duct joins the hepatic duct at an angle (acute) after running parallel with it, and cases in which the cystic duct assumes an anterior or posterior spiral course to the hepatic duct entering the latter either laterally, medially, or posteriorly.

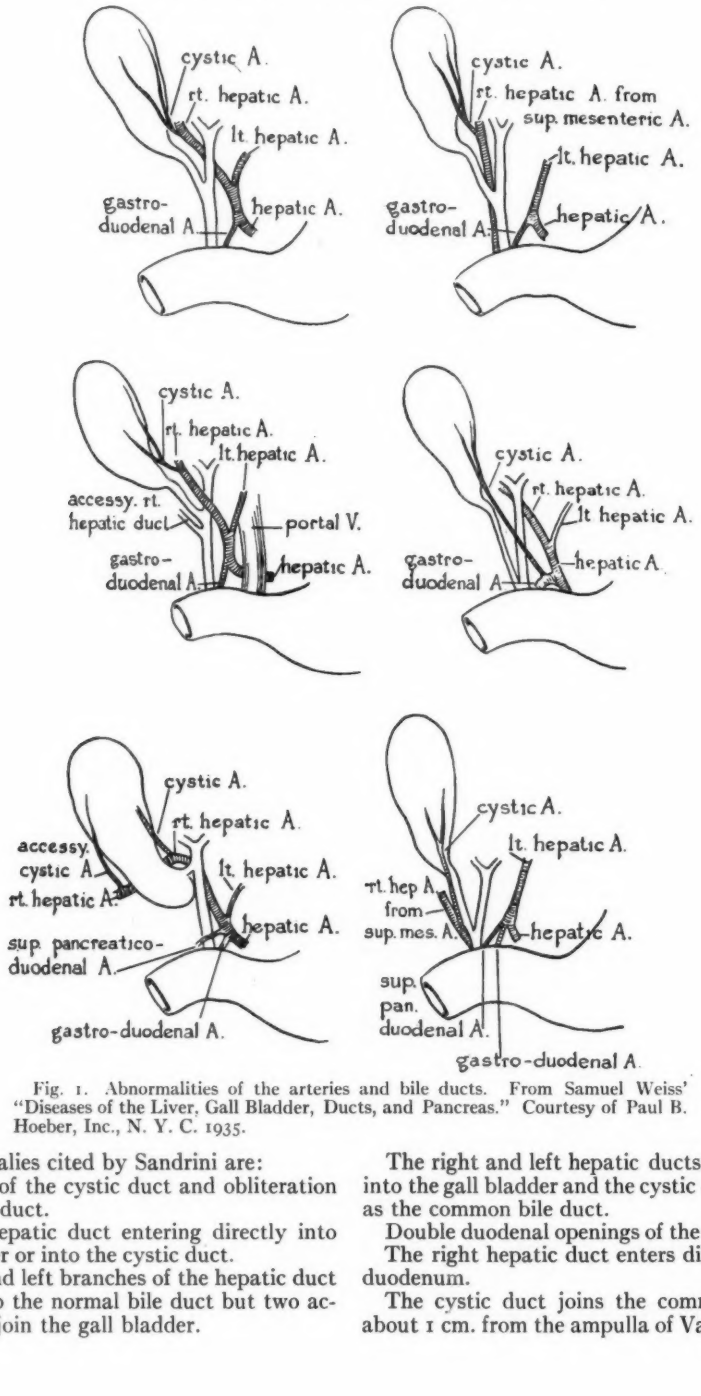

Fig. 1. Abnormalities of the arteries and bile ducts. From Samuel Weiss' "Diseases of the Liver, Gall Bladder, Ducts, and Pancreas." Courtesy of Paul B. Hoeber, Inc., N. Y. C. 1935.

Other anomalies cited by Sandrini are:

Bifurcation of the cystic duct and obliteration of the hepatic duct.

Accessory hepatic duct entering directly into the gall bladder or into the cystic duct.

The right and left branches of the hepatic duct are united into the normal bile duct but two accessory ducts join the gall bladder.

The right and left hepatic ducts enter directly into the gall bladder and the cystic duct continues as the common bile duct.

Double duodenal openings of the common duct.

The right hepatic duct enters directly into the duodenum.

The cystic duct joins the common bile duct about 1 cm. from the ampulla of Vater.

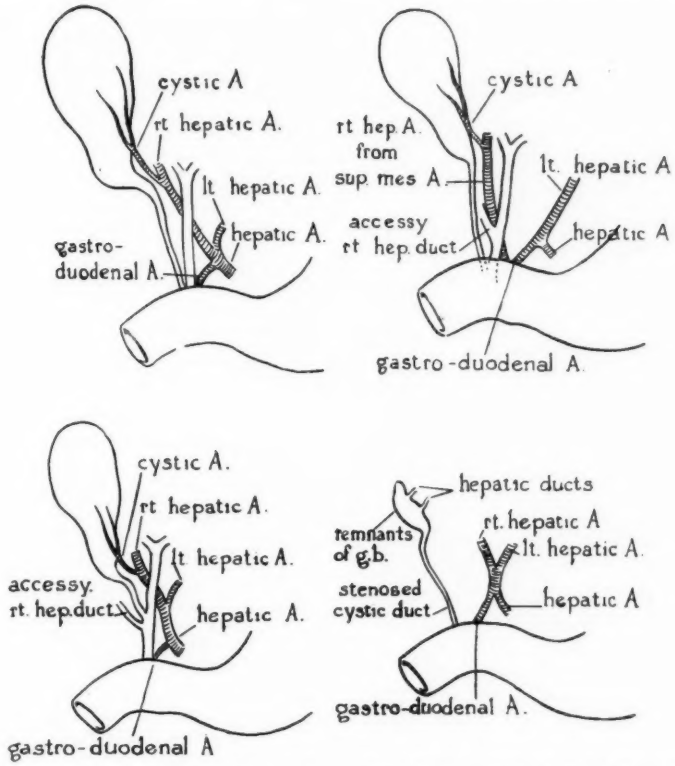

Fig. 2. Abnormalities of the arteries and bile ducts, continued. From Samuel Weiss' "Diseases of the Liver, Gall Bladder, Ducts, and Pancreas." Courtesy of Paul B. Hoeber, Inc. N. Y. C. 1935.

The hepatic ducts enter the neck of the gall bladder and the cystic duct continues as the common bile duct.

Sutton (38), by ligation of the hepatic arteries in dogs, has experimentally produced the so-called high temperature "liver death syndrome" (acute postoperative necrosis of the liver). This syndrome consisted of high fever, falling blood pressure, circulatory collapse, coma, and death, with a temperature as high as 109° Fahrenheit within from thirty-six to forty-eight hours after the operation. His work should help one to keep always in mind the necessity for adequate exposure and accurate observation before ligature of structures.

Babcock's (3) method of dealing with anomalous and accessory bile ducts includes the insertion of a small rubber drain to the region of the cystic duct as a routine measure in all operations. He remarks that "the surgeon is not infrequently amazed at the escape of bile from such a tube," after he believes he has securely closed all avenues for its leakage. Such a tube should be very carefully placed both in the wound and in the dressing so that it is not kinked or otherwise occluded. Particular emphasis is laid on this as a safety factor, as "the free leakage of bile into the peritoneal cavity, unless promptly corrected, will result in a fatal peritonitis in over 50 per cent of the cases."

The incision. The selection of an incision which will lessen the likelihood of occurrence of postoperative hernia is essential. A transverse or obliquely transverse incision through muscles which permits adequate exposure prevents the maintenance of intra-abdominal pressure and evisceration.

Anesthesia can be much less deep if the patient be deprived of his normal power of thus increasing the intra-abdominal pressure. If a muscle cut transversely to its long axis be accurately sutured it will heal perfectly, providing its enveloping

fasciæ are restored. Placement of incisions to avoid injury to nerves supplying the musculature is of greatest importance.

The precautions used by Babcock include prevention of postoperative hernia by a muscle-splitting operation in which the skin is divided nearly transversely on the line of the seventh intercostal space, from the anterior axillary line to the middle of the right rectus abdominis. The fibers of the external oblique muscle are separated, the anterior and posterior sheaths of the right rectus divided, and the rectus muscle is retracted to the left.

Ravdin states that subcostal incision has several anatomical advantages in biliary surgery. It provides access to a wide area of the liver edge. It is not necessary to sacrifice more than one intercostal nerve supplying the rectus muscle and because of the peculiarity of anastomoses of the nerve supply to the rectus, the severance of this nerve does not jeopardize the motor supply to the muscle. The exposure of the common duct is superb. The duct can be approached from the right as the closest structure in the right free border of the gastrohepatic omentum and damage to important structures is made less likely. Drainage can be easily brought out through the lateral abdominal wall. The anatomical relations at the junction of the cystic and common ducts must be carefully visualized, for damage to an abnormally placed right hepatic duct may prove difficult to repair, even though the injury is observed during operation. Ligation of an anomalous hepatic artery will result in death, a catastrophe which has frequently been ascribed to cardiac failure.

Briefly, in summarizing, the incision and its closure should take into consideration the following cardinal points:

1. The *incision* should be *adequate*. This may seem axiomatic but so often does the operator come to grief because of failure to adhere to this rule, that it bears repetition again and again. *Time taken in preparing an ample exposure is time very well spent.*

2. Vertical incisions or vertical portions of combined incisions are best confined close to the median line at which point the nerves are far from harm's way.

3. A subcostal incision is best not carried further laterally than the external border of the rectus muscle. This will prevent mass injury to several intercostal nerves entering the abdominal field in this vicinity.

4. Incisions lateral to the lateral border of the rectus muscle should be in the line of the abdominal portions of the intercostal nerves. The fibers of the external oblique muscle are separated. The other flat abdominal muscles may be cut but should be later very accurately sutured to insure perfect healing.

5. All muscle-enveloping fasciæ must be accurately restored, with interruption of the suture at several points in extensive incisions.

6. Incisions in the rectus sheaths are best made transverse, since the fascial fibers run in this direction. This incision also protects the nerves. It is permissible and often advisable to section the rectus muscle to obtain adequate exposure.

Exploration of the common duct. The question as to whether or not the operator should routinely explore the common duct is always of importance and interest. Crile says that the common duct should be opened only (1) if there have been chills, pain, and fever; (2) if the common duct is dilated; (3) if jaundice, not otherwise accounted for, appears; and (4) if stones can be palpated. However, the common duct is so often injured during cholecystectomy that surgical attention to it is frequently imperative. Jones (25) advocates "prevention of such injuries by visualization at the time of cholecystectomy," which means, of course, employment of an incision which permits adequate exposure. This will likewise reveal the occasional anomaly which introduces such uncertainty into even the most carefully thought out procedure. "The damage takes place because a great deal of traction is put on the gall bladder, angulating the common duct, with the result that either an oval segment is taken out of the duct by the curved clamp, or the duct is cut across completely." Lahey, writing of common-duct strictures seen after operation, says, "careful preliminary isolation of the cystic artery and its clamping and ligation before the cystic duct is cut in cholecystectomy, will prevent most of the cystic or hepatic artery hemorrhage which, in turn, will prevent duct injury and the production of duct strictures."

"In common duct drainage," says Hawkins, "there are several pitfalls to be avoided; first, the incision in the duct need not be larger than to permit the insertion of a folded T drain, or the removal of stones and, secondly meticulous attention should be given to the condition of the rubber T-tube itself . . . It is quite embarrassing in attempting to remove the drain postoperatively, to pull out only the upper portion!"

Ravdin advises that the common duct should be opened if dilated, even if there be no jaundice. In this he agrees with Lahey (*J. Am. M. Ass.*, 1929, 93: 1927). Stones are frequently present and the time to remove them is at the initial op-

eration. He drains with a small, soft rubber tube, though many authorities advise against such drainage. Patients with long-standing or complete common-duct obstruction should have a slow decompression of the biliary passages after operation. This can be accomplished in a manner similar to decompression of the urinary bladder, except that the means of preventing too rapid outflow of bile must be provided in a somewhat different manner. An apparatus has been devised by Ravdin and his coworkers which can be adjusted at will to regulate the external drainage of bile after cholecystectomy or other biliary surgery, and to direct the outflow into the duodenum. It is only necessary that the pressure from the decompression apparatus be sufficient to overcome the tonus of the sphincter mechanism at the lower end of the common bile duct for the bile to flow freely into the duodenum. As the bile enters by its normal route, appetite will usually improve at once and "pancreatic asthenia" will not be observed during convalescence.

One of the main factors which influence the chronicity of cholangitis, according to Judd, is the multiplicity of poorly drained parietal sacculi in the walls of the ducts throughout the whole biliary tree. When once established, the infection in these tortuous racemose diverticula is exceedingly difficult to eradicate unless some adequate means of drainage is provided, such as may be maintained by insertion of a Kehr-Deaver tube.

Postoperative Safeguards

Postoperative colic; patency of the common duct. For control of colic which persists after removal of the gall bladder, Babcock has found daily injections of small doses of insulin very useful, and this therapy has been recommended by other surgeons.

Butsch, McGowan, and Walters (6) found that morphine constricts the sphincter of Oddi and raises the pressure in the common bile duct to 300 mm. of water, which is the secretory pressure of the liver. Thus, morphine, at least alone, would not be a good drug to administer after operation to a patient who has a low liver reserve. For the same reason, a drug which elevates intrabiliary pressure should be used with caution in cases of biliary fistula or in cases in which a biliary fistula is feared. These authors found nitrates effective clinically, both in reducing an elevated biliary pressure and in relieving the accompanying pain. They obtained complete relief clinically in a series of cases of postcholecystectomy colic by the use of glyceryl trinitrate. There was not sufficient opportunity to observe the action of theophylline ethylenediamine (aminophyllin) clinically. All the alkaloids of opium commonly used as analgesics cause a rise of intrabiliary pressure and may prolong the pain for the relief of which they have been given.

More recently the use of atropine or syntropan by injection, nitroglycerin under the tongue, and saline laxative by mouth or stomach tube has been resorted to for the relief of sphincter spasm. If the common duct has been drained, the injection through the drainage tube of warm olive oil and/or saline solution to remove gravel, and of one of the radiopaque dyes (diodrast) to rule out a stone possibly left behind and to verify the patency of the common duct has been recommended.

Judd determines duct patency by fluoroscopy after the injection of radiopaque oil through the external arm of the drainage tube. By this means one can determine also the feasibility of removing the tube. Judd remarks that many patients in the later decades of life are in poor condition to withstand the extensive operation so often required because of the presence of stones or other serious complications. However, even under those circumstances, careful preparation will often enable an aged and debilitated person to pass safely through the intervention. He reports the case of a woman of seventy-four, on whom choledocholithotomy, cholecystectomy, and choledochostomy were performed in one stage. Prolonged free drainage was instituted with a T-tube in the common duct, where it remained from August 10 to September 7, the patient leaving for home on September 12 in excellent condition. In another case, that of a man forty-three years old, the T-tube was left in for six months and a half.

Ravdin finds a slow intravenous drip of glucose and saline solution of great value. After the release of biliary-tract obstruction, glucose aids the recovery of the hepatic cells. In severe or prolonged jaundice, repeated transfusions of from 250 to 500 c.cm. of blood, once or twice a day may reduce the incidence of hemorrhage and bring about smoother convalescence. If bleeding occurs, more and larger transfusions are given. The blood count and blood pressure are kept at safe levels no matter how much blood may be necessary to accomplish this.

Causes of death. Ravdin and his coworkers believe myocardial failure to be one of the major causes of death. They cite Riesman and Babcock (*J. Am. M. Ass.*, 1909, 73: 1929) as having independently suggested that the streptococcus, the most frequent organism found in biliary-tract infection, also causes myocardial degeneration.

They believe that patients with serious cardiac disease at the time of operation probably had some initial cardiac lesion prior to the biliary-tract disease. These patients, if not protected during and after operation, present serious risks, but these authors' experience shows that cardiac improvement will follow properly safeguarded biliary surgery. A cholecystostomy under local anesthesia may give gratifying results.

Walters writes that improved therapy has decreased pulmonary and other complications at the Mayo Clinic. In operations for cholecystitis in 1937 there were 11 deaths from bronchopneumonia (1.2 per cent), while in 1938 there were 4 deaths (0.4 per cent). Among factors responsible for this reduction are sulfanilamide, sulfapyridine and allied substances, bronchial aspiration, the use of oxygen, blood transfusions, and specific sera in certain types of pneumonia. The surgical staff can call at all hours upon the internist group. Vitamin K and bile salts have reduced hemorrhage in jaundiced patients and possibly their administration has improved liver function. The principal causes of death were: (1) bronchopneumonia, (2) hepatic insufficiency, (3) cardiovascular renal disease, and (4) pulmonary embolism.

Heyd (21a), in a study of the mortality factors in 4,000 operations upon the external biliary system, reported 309 deaths, or a mortality of 7.7 per cent. He concluded that chronic biliary disease is a progressive pathological condition, morbidity and mortality being dependent upon (1) the duration of the disease, (2) the pathology present, (3) the complications, and (4) the physical condition of the patient.

Mortality in relation to pre-operative preparation.

TABLE II.—THE MORTALITY AND MORBIDITY IN ACUTE CHOLECYSTITIS IN RELATION TO THE LENGTH OF PRE-OPERATIVE HOSPITALIZATION.

Duration of observation period	No. of cases	Per cent perforated	Mortality per cent
0 to 6 hours	128	10.0	15.6
6 to 24 hours	297	13.1	7.4
24 to 48 hours	56	8.6	10.35
2 to 24 days	93	12.8	17.60
Totals	574	12.1	10.97

An immediate operation for acute cholecystitis, within six hours after admission, is only seldom indicated. To insure best results, from six to twenty-four hours of pre-operative preparation is indicated. On the other hand, operation and preparation for much over forty-eight hours again increased the risk.

Mortality in relation to pathology.

TABLE III.—ACUTE CHOLECYSTITIS, PATHOLOGICAL ANALYSIS OF 574 OPERATIONS

Pathological diagnosis	No. of cases	Per cent of total	Mortality per cent
Acute cholecystitis	206	36.0	5.85
Purulent cholecystitis	117	20.4	9.40
Gangrenous cholecystitis	150	25.9	7.33
Perforation, with abscess	16	2.8	0.00
Perforation, with peritonitis	53	9.2	35.85
No pathological report	32	5.7	34.40
Total cases	574	100.0	10.97

Any grade of jaundice increases the mortality in chronic cholecystitis; the mortality rate was 13 per cent in 254 cases of jaundice at time of operation; and 85 per cent of these had stones in the common duct. In 574 cases of acute cholecystitis, 542 cholecystectomies were done; 32 patients had a cholecystostomy. In 46 cases of perforation of the gall bladder with chronic cholecystitis there was a mortality of 19.5 per cent; 9 of these patients had perforation into the colon. Involvement of the common duct in gall-bladder disease raises the mortality from 3.61 to 11.4 per cent. Surgery of the common duct gives a mortality 3 times as high as uncomplicated cholecystectomy. Previous attacks of jaundice increased the mortality. Jaundice itself increases the mortality by 100 per cent.

Mortality in relation to the operative procedure. In the early series since 1920, exploration of the common duct was done only for marked disease of the duct or associated pancreatitis. Later, with improved technique, more primary explorations of the duct were done. Drainage of the duct for calculus or cholangitis at the initial operation, done with cholecystectomy, gave a mortality of 11.34 per cent; whereas choledochostomy following initial cholecystectomy gave a mortality of 38.6 per cent. The lowest mortality occurred in a series of 959 patients who were operated upon no longer than two years after gall-bladder symptoms started (1.35 per cent).

Cholecystostomy for chronic cholecystitis was inadequate. Sixty-eight patients were operated upon a second time following cholecystostomy for recurrent symptoms with a mortality of 7.4 per cent.

Choledochostomy for postoperative stenosis of the common bile duct or stones previously overlooked gave almost a 40 per cent mortality. Combination of operations is conducive to high mortality. In 575 operations, cholecystectomy combined with other procedures gave the mor-

tality of 13.85 per cent. The mortality is even higher when such operations as appendectomy for gangrene, gastroduodenal ulceration, or fibromyoma of the uterus are carried out with cholecystectomy.

Cholecystostomy was done in 2 per cent of the operations for chronic gall-bladder disease. In 3,306 operations for chronic cholecystitis, cholecystostomy was done 66 times with a mortality of 33.3 per cent. Cholecystogastrostomy was done 50 times and cholecystoduodenostomy twice; the mortality was 28.8 per cent. There were 52 anastomotic operations for carcinoma and 16 for pancreatitis with obstruction.

Postoperative pulmonary complications.

Atelectasis and pneumonia. Biliary-tract surgery is notorious for its aftermath of lung complications. The pathogenesis of these complications is becoming more and more understood and appreciated. Curiously enough, the type of anesthesia does not appear of paramount importance in their production. Of greater importance is the debilitated state of the patient, the depressing effect of narcotics and anesthesia on respiration, and the accumulation of infected bronchial secretions due to a combination of poor mouth hygiene, narcotics, anesthesia, unchanged posture, and constrained breathing due to pain. The admirable review of this phase of the subject by Gius (16) is well worth consulting. No longer should one depend on good fortune for avoiding lung complications; the initiative for their prevention should emanate from the surgeon.

Venous thrombosis and pulmonary embolism. In a study of 100 cases of embolism, De Takats and Jesser (11) found that 60 per cent of the patients lived for more than one hour and 34 per cent for from one to several days following the accident. Thus it appears that time is available for therapy. They summarize the blood changes predisposing to thrombosis and embolism as follows:

> An increase in the number of platelets occurs regularly after any major operation, with a maximum peak between the eighth and eleventh days; there are an increase in fibrinogen, a shift of the albumin-globulin ratio in favor of globulin, and an increase in blood viscosity. All these factors facilitate the agglutination of platelets. The coagulation of blood is favored by the postoperative leucocytosis and the increase of platelets, both of which liberate thrombokinase and hasten the coagulation of stagnating blood adjoining an obstructing platelet thrombus. Blunt dissection, trauma, infection, advanced age, and overweight predispose to thrombosis.
>
> Pulmonary embolism may be ushered in with dyspnea, pain in the chest, cyanosis, a weak rapid pulse, shock, restlessness, nausea, vomiting, abdominal pains, chill, vertigo, convulsions, or rapid death.

Only too often embolism is passed off with a diagnosis of cardiac failure, coronary occlusion, shock and/or hemorrhage, pulmonary edema, coma, or a cerebrovascular accident. De Takats and Jesser point out the marked retardation of blood flow after every major abdominal operation, with narrowing of the axial stream and the assumption of a marginal position by the leucocytes and platelets. Venous backflow is discouraged by immobilization in bed, tight abdominal binders, postoperative pain, intestinal distention, superficial breathing, and diminished excursion of the diaphragm; the emptying time of the inferior vena cava and peripheral veins is prolonged. Pulmonary embolism is not always associated with asphyxia, failure of the right heart, or insufficient venous return to the left heart except when the main pulmonary artery or both its branches are obstructed. De Takats and Jesser found that a small embolus to only a small portion of lung may be fatal which they believe is due to a radiation of autonomic reflexes and vagal effects which can be demonstrated experimentally on the electrocardiogram. These vagal effects constrict the smooth muscle of the coronary arteries, the bronchi, and the upper gastrointestinal tract. Therefore, they use atropine to block the vagus and papaverine to relax smooth muscle in the treatment of embolism. For prophylaxis, besides hydration to prevent slowing of the blood stream, they use a mild Trendelenburg position, with the foot of the bed raised five degrees for twenty-four hours postoperatively to accelerate venous backflow from the extremities and pelvis. Bicycle pedals mounted on the foot of the bed are used by the patient to improve the circulation.

In diametric opposition so far as posture is concerned, Frykolm (15) uses a Fowler position for prophylaxis. The rationale of this procedure is summarized by him as follows:

> 1. Several series of pathologico-anatomical investigations have been made during the past years and have proved that there are four areas of origin of venous thrombosis: (a) the plantar veins, (b) the veins of the musculature of the calf, (c) the branches of the deep femoral vein in the adductor musculature, and (d) the visceral pelvic veins.
>
> 2. When a patient is confined to bed, the veins of the areas mentioned are collapsed or pressed together to a certain degree, so that two intima layers come into close contact.
>
> 3. The vitality of the endothelial cells depends, to a great extent, on their contact with flowing blood, and when the cells are deprived of this source of nutrition, disturbances arise in nutrition, as a thrombosing process is begun.
>
> 4. Injury to the intima is the most important factor in the pathogenesis of thrombosis. It can be counteracted by raising the head of the bed so that the patient begins to slide downward in bed. Then the venous pressure in the

extremities will rise, so that the veins become distended with blood, and the patient will be forced to make active movements with her legs to maintain her position. Thus the veins which are especially threatened by thrombosis will be rhythmically emptied and distended.

Report of Cases

Case 1 (No. 4901). A woman aged sixty-two, admitted September 12, 1935, and discharged September 19.

Chief complaint: Pain in the upper right quadrant for two and one-half weeks radiating to the back and right shoulder. The patient had had similar attacks during the past eight years with belching and distention after meals.

Physical examination: Well developed and nourished female with tenderness over the right upper quadrant. The conjunctiva and sclera showed a yellow tinge.

Laboratory findings: The blood sugar was 170 mgm.; non-protein-nitrogen 23 mgm.; icterus index 119; carbon-dioxide-combining power 50.4; Van den Bergh (direct) delayed reaction, (indirect) positive. Cholesterol 223 mgm.; Ehrlich's aldehyde reaction for urobilin was positive.

Pre-operative diagnosis: Chronic cholecystitis with cholelithiasis, hepatitis, cholangitis, and pancreatitis; twenty-four hours after operation a transfusion of 500 c.cm. of blood was given.

Operation: Choledochostomy and choledocholithotomy under spinal anesthesia.

Operative findings: On opening the peritoneal cavity, serous fluid was evacuated. The liver was green, hob-nailed and hard. The pancreas was hard and infiltrated. A large mass was found attached to the duodenum and extended up toward the liver. Attached to this mass was a contracted obliterated fibrous gall bladder. The common duct was opened and a large calculus was removed. A T-tube was placed in the common duct. A cigarette drain was placed in Morison's pouch.

Twenty-four hours postoperatively, a transfusion of 500 c.cm. of blood was given.

Postoperative course: The biliary drainage was very free. The patient was restless and irritable and refused nutrition by mouth. The pulse ran thready, respirations increased rapidly, and the patient expired thereafter.

Pathological findings: (A. S. Price) Cholelithiasis.

Case 2 (No. 4487). A woman, aged thirty-nine, was admitted July 30, 1936, and discharged August 19.

Chief complaint: Pain in the epigastric region. Three months previously she had had severe cramplike pain in the lower right chest radiating to the small of the back and shoulder blade.

Physical examination: Well developed, rather obese, white female, very jaundiced and evidently in pain. There was tenderness and spasticity in the right upper quadrant.

Pre-operative diagnosis: Chronic cholecystitis.

Operation: Cholecystectomy and choledochostomy under nitrous oxide, oxygen, and ether anesthesia.

Findings: The liver was large, markedly degenerated and friable. The gall bladder was of yellow white color and collapsed. The common duct was dilated and the head of the pancreas very firm.

Procedure: The peritoneum was incised over the common duct and a very short cystic duct was brought into view. The common duct was incised and a probe was passed into the duodenum and no calculi were found. A T-tube was placed in the common duct and the gall bladder was removed.

Postoperative diagnosis: Chronic cholecystitis. Hepatitis. Pancreatitis.

Pathological findings: (Price) Chronic cholecystitis.

The patient made an uneventful recovery.

Case 3 (No. 6793). A woman, aged fifty-six, was admitted November 19, 1936, and discharged December 10, readmitted June 1, 1937, and discharged June 18.

Chief complaint: Severe pain in upper right quadrant, nausea and belching of gas on and off for ten years. A day before admission the pain became unbearable. A few days before admission she became jaundiced.

Physical examination: Pain and tenderness in upper right quadrant with jaundice.

Pre-operative diagnosis: Empyema of gall bladder.

Operation: Cholecystostomy with removal of stone from the cystic duct under nitrous oxide, oxygen, and ether anesthesia.

Operative findings and procedure: The gall bladder was about 5 in. in length, very distended, and tender. After evacuating the gall bladder of bile, the common duct was examined and no stones were found. There was a small stone at the mouth of the cystic duct which was milked into the wound and removed. The liver was greenish gray in color. A cholecystostomy was done.

Pathological findings: The specimen consisted of a soft, bile calculus measuring 1 by ¾ cm. The patient was discharged twenty-one days after admission with a biliary fistula. The patient was readmitted on June 1, 1937 because of a biliary fistula.

Pre-operative diagnosis: Stone in common duct.

Re-operation: Choledocholithotomy. Cholecystectomy under nitrous oxide, oxygen, and ether anesthesia.

Operative findings: Small stone in common duct and pericholecystic adhesions.

Procedure: The scar of the previous operation was excised and the sinus tract was dissected. The adhesions between the gall bladder and omentum were freed. The adhesions between the neck of the gall bladder and duodenum were released by sharp dissection. The gall bladder was markedly edematous and very long. A stone, the size of a small marble, was located in the common duct (supraduodenal). A 2½ cm. incision was made in the common duct. The stone was removed and the duct was drained. The gall bladder was removed. A cigarette drain was placed against the raw surface of the liver and another down to the opening of the common duct through which the soft rubber catheter emerged.

The patient improved and was discharged from the hospital June 18 with a fistula which closed five weeks later. The patient has remained well since.

Case 4 (No. 750). A woman, aged forty-two, was admitted February 6, 1937, and discharged April 3.

Chief complaint: Jaundice and itching. The patient had had gall bladder and "stomach trouble" for five years; sour eructations, and a "burning pain" in the epigastrium five months previously. She had had pain in the right upper quadrant and slight jaundice followed by rapid improvement. Eight days before admission, she was seized with sharp pain in the gall-bladder region radiating to the back and across the abdomen to the left flank and required morphine.

Physical examination: This patient was short, obese, and markedly jaundiced.

Laboratory findings: Erythrocytes-3,480,000, hemoglobin-65 per cent, non-protein-nitrogen 54, urea nitrogen 33 mgm., chlorides 540, icterus index 35.1, bilirubin 3.55; the urine was strongly positive for bile and contained occasional, coarse, granular casts.

Pre-operative diagnosis: Chronic cholecystitis and calculus in common duct.

Operation: Choledocholithotomy under nitrous oxide, oxygen, and ether anesthesia.

Procedure and operative findings: A green liver presented itself with multiple white nodules, quite thickly

demonstrated in the area of the gall-bladder attachment. The gall bladder was thickened and mottled and no stones were found. A small section of liver was removed for biopsy. After separating the adhesions between the common duct, duodenum, and hepatic flexure of the colon, the common duct was palpated and a calculus about the size of a hazelnut was felt. The common duct was incised and a large quantity of "white bile" was evacuated. The stone was removed with difficulty because of its size. A small T-tube was placed in the common duct. Following this procedure the gall bladder collapsed. It was thought best not to remove it because of the poor condition of the patient. A rubber dam drain was placed in Morison's pouch.

Postoperative course: On the twelfth postoperative day, bile was still present in the urine with occasional granular casts. The blood showed 1,400,000 erythrocytes and 28 per cent hemoglobin. A transfusion of 500 c.cm. was given and on the eighteenth postoperative day bile and occasional coarse granular casts were present in the urine. The blood showed 2,900,000 erythrocytes with 38 per cent hemoglobin and another transfusion of 500 c.cm. was given.

Pathological findings: (A. S. Price) A calculus measuring about 1½ cm. in diameter and a portion of the liver measured 2 by 1 cm. by 1 cm. The liver was dark green and densely bile-stained; "advanced biliary cirrhosis" and choledocholithiasis.

The patient improved gradually and was discharged twenty-three days later.

CASE 5 (No. 2989). A woman, aged fifty, was admitted May 13, 1937, and discharged June 5.

Chief complaint: Pain in the right upper quadrant to the back and right shoulder with vomiting on and off for past twenty years. Had mucous diarrhea for past five years.

Physical examination: Obesity, tenderness in upper right quadrant, abdominal distention.

Pre-operative diagnosis: Chronic cholecystitis.

Operation: Cholecystectomy, repair of fistulous opening in transverse colon under nitrous oxide, oxygen, and ether anesthesia.

Operative findings: The entire neck and fundus of the gall bladder were bound down by dense adhesions to the transverse colon. There were 2 large stones, the size of marbles within the gall bladder. The gall bladder was markedly distended and edematous. The liver was grayish in color. There were no stones in the common duct.

Procedure: The transverse colon was freed from the gall bladder. The fistulous tract between the transverse colon and gall bladder was isolated and considerable purulent material was evacuated from the gall bladder. The gall bladder was incised and 2 large stones were removed. The opening in the transverse colon was repaired and covered with a piece of omentum. The gall bladder was removed and drainage was instituted.

Pathological findings: (A. S. Price) The specimen consisted of a gall bladder 10 cm. in length. The wall was thickened and showed areas of ulceration in the mucosa. Two large-sized calculi were found measuring 3 and 2½ cm. in diameter. Acute and chronic cholecystitis, cholelithiasis, and periportal hepatitis.

The patient has been enjoying excellent health since the operation except that she developed a postoperative incisional hernia.

CASE 6 (No. 5878). A man, aged forty, was admitted September 26, 1938, and discharged October 23.

Chief complaint: Pain in the upper right quadrant, gnawing in character and recurring several hours after meals for eight years. For the past four years he had had several Lyon's drainages. Roentgenographic examination of the gall bladder gave the impression of an obstructive cholecystitis with stones.

Pre-operative diagnosis: Cholecystitis and cholelithiasis.

Operation: Cholecystectomy, choledochostomy under nitrous oxide, oxygen, and ether anesthesia.

Operative findings: The gall bladder was thickened, grayish white in color, very edematous, adherent to the hepatic flexure of the colon and duodenum. The common duct was markedly dilated.

Procedure: The common duct was opened. A probe was inserted toward the liver and the ampulla below but no calculi were found. Bile flowed freely from the upper portion of the duct. A T-tube was placed in the common duct and the gall bladder was removed.

Pathological findings: (A. S. Price) Subacute and chronic cholecystitis and cholelithiasis.

The patient made an uneventful recovery.

CASE 7 (No. 7828). A woman, aged fifty-seven, was admitted December 15, 1938, and discharged February 11 1939.

Chief complaint: On day of admission she was awakened by sudden, severe upper abdominal pain which persisted.

Physical examination: Obesity, acute illness with rigidity and tenderness over gall-bladder region.

Pre-operative diagnosis: Acute cholecystitis.

Operation: Cholecystostomy under spinal anesthesia.

Operative findings: The omentum was found firmly adherent to the lateral and anterior parietal wall. There was a large amount of serous fluid in the peritoneal cavity. The gall bladder was edematous, distended, and gangrenous in appearance.

Procedure: The gall bladder was opened and drained by an indwelling catheter. Drains were also placed in the foramen of Winslow and Morison's pouch.

Complications: Peritonitis, paralytic ileus, and lobar pneumonia.

The patient recovered and was discharged six weeks postoperatively.

CASE 8 (No. 154). A woman, aged forty-seven, was admitted January 8, 1939, and discharged February 7.

Chief complaint: Two days prior to admission, the patient was seized with pain in the upper right quadrant which had gradually become worse.

Physical examination: Extreme tenderness and rigidity over gall-bladder region.

Pre-operative diagnosis: Acute cholecystitis.

Operation: Cholecystectomy under nitrous oxide, oxygen, and ether anesthesia.

Operative findings: The liver showed small, whitish, granular flecks on the superior and inferior surfaces; there were so-called "violin-string" adhesions between the dome of the liver and the diaphragm. The fundus of the gall bladder was adherent to a band that ran from the duodenum to the hepatic colon.

Procedure: The fundus of the gall bladder was freed and a cholecystectomy performed.

Postoperative diagnosis: Perihepatitis (gonococcic); chronic cholecystitis. (Cervical smears were, however, negative for gonococci.)

The patient was discharged in good condition on the twenty-first postoperative day.

CASE 9 (No. 3431). A woman, aged forty-seven, was admitted May 31, 1939, and discharged June 30.

Chief complaint: Pain in right upper quadrant and epigastric distress for the past six or seven years. The patient had had frequent attacks of pain in the right upper quadrant with nausea. The pain would last about an hour, was severe and sharp, and often radiated to the angle of the scapula.

Physical examination: Soft and protuberant abdomen with tenderness over the gall-bladder region. The roentgenographic examination showed a large diverticulum of

the second portion of the duodenum. The gall bladder was poorly visualized.

Pre-operative diagnosis: Chronic cholecystitis and diverticulum of the descending portion of the duodenum (outer wall).

Operation: Excision of diverticulum, cholecystectomy under nitrous oxide, oxygen, and ether anesthesia.

Operative findings and procedure: The duodenum was explored from the pylorus to the beginning of the third portion by mobilizing it according to the method of Kocher. The diverticulum was found on the descending portion of the duodenum. On the outer lateral wall, a Doyen clamp was placed on the duodenum and the diverticulum was excised. The gall bladder, which was thickened and adherent, was removed.

Pathological findings: Chronic duodenitis with chronic catarrhal cholecystitis.

The patient was discharged in good condition.

CASE 10 (No. 4975). A woman, aged fifty-nine, was admitted August 2, 1939, and died August 31.

Chief complaint: Vomiting, right upper quadrant pain, anorexia, loss of weight, jaundice. About three weeks previously, the patient began having pain in the upper right quadrant and vomited. On one occasion, she vomited 3 gall stones which she brought with her. She had not been able to retain much food. Her weight on admission was 130 lb., one year ago it was 180 lb.

Physical examination: A fairly well developed but poorly nourished woman. She appeared slightly toxic, chronically ill, and slightly jaundiced. The abdomen was relaxed and there was a large, tender mass in the right upper quadrant.

Pre-operative diagnosis: Chronic cholecystitis and cholelithiasis.

Operation: Cholecystostomy and removal of 2 calculi under nitrous oxide, oxygen, and ether anesthesia.

Operative findings: On opening the peritoneal cavity, a large mass of edematous omentum with marked degeneration of liver was observed.

Procedure: The adhesions were very well organized and very vascular and it was with difficulty that any separation could be made by ligating the vascular adhesions and cutting between them until the gall bladder was palpated. In separating the gall bladder from the adhesions, it was accidentally opened and 2 calculi were removed, but other calculi were palpated high up apparently in the liver structure but could not be removed. There was marked necrosis and oozing from the pancreas which was controlled by packing; cholecystostomy was done.

Progress: The patient progressed satisfactorily following operation. Drainage of bile from the wound was profuse. On the twenty-fifth postoperative day, the patient became cold and clammy and appeared moribund. In spite of supportive treatment, she expired on the twenty-eighth postoperative day.

Findings: (A. S. Price) The specimen consisted of a small portion of fatty tissue and 3 facetted calculi of mixed type averaging ¾ cm. in diameter.

Diagnosis: Cholelithiasis.

CASE 11 (No. 2331). A woman, aged fifty-three, was admitted April 18, 1939, and discharged May 17.

Chief complaint: Pain in the upper right quadrant. The patient stated she was entirely well until two weeks ago at which time she began having pain in the right upper quadrant requiring morphine.

Physical examination: A rather obese patient, with no rigidity or tenderness on deep pressure over gall-bladder region; very active peristalsis.

Pre-operative diagnosis: Acute cholecystitis.

Operation: Cholecystectomy, closure of fistula in hepatic colon under nitrous oxide, oxygen, and ether anesthesia.

Operative findings: An indurated mass presented itself in the area of the gall bladder, omentum, and colon. The gall bladder was not seen.

Procedure: The adhesions of the hepatic colon were separated and an abscessed, fistulous tract was found between the fundus of the gall bladder and the hepatic colon. The gall bladder was thickened and the cystic duct was enlarged, infiltrated, and contained a calculus. A cholecystectomy was performed and the hepatic colon was repaired with silk and an omental graft. Morison's pouch was drained with 2 dental dam drains.

Pathological findings: Subacute and chronic empyema of the gall bladder.

The patient was discharged in good condition on the twenty-ninth postoperative day.

CASE 12 (No. 7820). A man, aged fifty-two, was admitted Dec. 19, 1939, and discharged Jan. 16, 1940.

Chief complaint: Jaundice and itching. Six weeks previously, there was eructation of gas with slight upper abdominal pain and gradually increasing jaundice.

Physical examination: A well developed and nourished male with deep jaundice, not appearing acutely ill. The liver was enlarged up to the fourth interspace; the spleen was not palpable. No free fluid in the abdomen.

A roentgenographic examination of the gall bladder was made. The gall bladder was not visualized. The stomach, duodenum, and colon were normal.

Laboratory examination: Urine showed a trace of albumin and bile on December 19.

Blood examination: erythrocytes—3,760,000; hemoglobin 78 per cent; leucocytes 4,250; polynuclears 76 per cent; lymphocytes 19 per cent; eosinophiles 2 per cent; basophiles 2 per cent. Icterus index 90.0, Van den Bergh (direct) immediate reaction, Van den Bergh (indirect) 12.5 units, prothrombin time prolonged, coagulation time four minutes twenty seconds, bleeding time two minutes forty seconds.

Fragility test: Initial hemolysis: 0.30, complete hemolysis: none.

Blood culture: No growth in seventy-two hours.

Postoperative laboratory examination: Blood sugar 95 mgm. on December 28. Gall bladder culture (Lyon's drainage) showed no growth in forty-eight hours. On December 30 urine showed trace of albumin, color—turbid, sediment—tyrosin crystals; icterus index 70.0, Van den Bergh (direct) immediate, Van den Bergh (indirect) 9.3 units. Coagulation time three minutes, forty seconds; bleeding time one minute, thirty seconds. Prothrombin time thirteen minutes.

Stool examination: Clay colored stool, no bile present. On January 9 examination of bile revealed no crystals. From 15 to 20 leucocytes per high power field. Stool specimen for bile negative.

On January 12 the icterus index was 41.0. The gastrointestinal series was negative; the gall bladder was not visualized by Graham dye.

Pre-operative diagnosis: Obstructive jaundice with hepatitis.

Operation: Cholecystostomy, removal of stone from and drainage of common duct.

Operative findings: On opening the peritoneum, marked cirrhosis of the liver was seen. The gall bladder was small. There were dense adhesions between the neck of the gall bladder and ascending portion of the duodenum. With a finger in the foramen of Winslow, the common duct was palpated and no stones were found at this time. However, when the transverse mesocolon was made taut, a small stone was detected at the ampulla between the finger in the foramen of Winslow and the finger over the head of the pancreas

Procedure: The stone was moved upward above the duodenum with great difficulty and removed through an incision in the common duct. A soft catheter was introduced into the hepatic duct. Irrigation of the hepatic duct yielded a few pieces of gravel. The same catheter was reversed downward toward the ampulla and the common duct was irrigated with saline solution. T-tube drainage was instituted. A rubber dam drain was placed in the foramen of Winslow. A cholecystostomy was performed. A rubber dam drain was placed in Morison's pouch.

Pathological findings: The specimen consists of a calculus of mixed type about 10 mm. in diameter.

Postoperative course: The patient's condition was satisfactory. He drained considerable bile at first, which was very black and finally became golden yellow, but his jaundice did not clear. On roentgen films of the biliary tract, taken January 11, following the injection of diodrast through the T-tube, the common duct, hepatic duct, and second portion of the duodenum were well visualized. There was free flow of dye through the common duct into the duodenum and no evidence of calculus in the biliary tract. Following this, the T-tube was removed. The fistulous tract closed in two weeks. The jaundice has not quite entirely cleared to date.

CASE 13 (No. 335). A woman, aged sixty, was admitted January 15, 1940 and discharged February 14.

Chief complaint: Occasional attacks of "indigestion" for several years. She had had a cholecystostomy twelve years previously. A recent roentgenogram of the stomach and duodenum showed a pyloric obstruction very likely due to carcinoma and a duodenal diverticulum.

Physical examination: An obese woman with a yellow tinge to the skin and conjunctiva, and with tenderness in the right upper quadrant and over the scar of previous operation.

Pre-operative diagnosis: Pyloric obstruction and duodenal diverticulum.

Operation: Cholecystectomy, inversion of diverticulum, and liberation of dense adhesions encircling the region of the pylorus under nitrous oxide, oxygen, and ether anesthesia.

Operative findings and procedure: On opening the abdomen, dense adhesions were encountered between the liver, omentum, and pylorus. No sign of ulcer or carcinoma of the stomach or pylorus. The pancreas and common duct were considered normal. The adhesions were separated. The gall bladder, which contained no stones, was freed from the adherent structures and removed. A diverticulum presented in the anterior surface of the second portion of the duodenum. It was ¾ in. in diameter and its base about ¾ in. in diameter. The diverticulum was rather thin; it was inverted into the duodenum with a purse-string suture of fine silk. A cigarette drain was introduced into the foramen of Winslow.

Pathological findings: (A. S. Price) The gall bladder was about 8 cm. in length. A number of cholesterin deposits were found in the mucosa ("strawberry gall bladder"). Chronic cholecystitis.

The patient was discharged in excellent condition and has remained well since.

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SUMMARY

The utilization of safety factors in the modern treatment of biliary-tract diseases presupposes a knowledge of their pathogenesis, of the anatomy and anomalies of the region, and of biliary physiology and pathological physiology.

Such knowledge, together with good judgment, skill, and experience, constitutes the surgical wisdom which is essential for diagnosis and for the logical and safe pre-operative, operative, and postoperative management of the patient.

BIBLIOGRAPHY

1. ALTSHULER, S. S., HENSEL, H. M., and SAHYUN, M. The Maintenance of Nitrogen Equilibrium of Amino-Acids Administered Parenterally. Am. J. M. Sc. 1940, 200: 239.
1a. ANDRUS, W. DE W. and LORD, J. W., JR. Correction of Prothrombin Deficiencies. J. Am. M. Ass., 1940, 114: 1336.
2. ANSBACHER, S., and FERNHOLZ, E. Simple Compounds with Vitamin K Activity. J. Am. Chem. Soc., 1939, 61: 1924.
3. BABCOCK, W. W. Problems in the Surgical Treatment of Biliary Disease. Rev. Gastroenterol., 1937, 4: 267.
4. BOYCE, F. F. An Analysis of the Mortality of Gall Bladder Surgery. Surg., Gynec. & Obst., 1936, 63: 43.
5. BOYD, P. L. Operative Mortality of Cholecystitis. New England J. Med., 1938, 218: 1045.
6. BUTSCH, W. L., MCGOWAN, J. M., and WALTERS, W. Clinical Studies on Drugs in Biliary Pain. Surg., Gynec. & Obst., 1936, 63: 451.
7. CHAIKIN, N. W. Carcinoma of the Head of the Pancreas with Metastases to the Liver without Jaundice. Bull. N. Y. Med. College Flower and Fifth Ave. Hosp., 1940, 3: 41.
8. COLP, R. Acute Cholecystitis Associated with Pancreatic Reflux. Ann. Surg., 1936, 103: 67.
9. CRILE, G. W. Pathologic Physiology of the Liver and Gall Bladder. South. Surgeon, 1934, 3: 171.
10. CURTIS, A. H. A Cause of Adhesions in the Right Upper Quadrant. J. Am. M. Ass., 1930, 94: 1221.
11. DE TAKATS, G., and JESSER, J. H. Pulmonary Embolism, J. Am. M. Ass., 1940, 114: 1415.
12. EISS, S. Conservation of Hepatic Function in Gall Bladder Operations. Ann. Surg., 1933, 98: 348.
13. ERDMANN, J. F. Common Duct Injuries and their Reconstruction. South. Surgeon, 1935, 4: 180.
14. FITZ-HUGH, T., JR. Acute Gonococcic Perihepatitis; A new syndrome of right upper quadrant abdominal pain in young women. Rev. Gastroenterol., 1936, 3: 125.
15. FRYKOLM, R. The Pathogenesis and Mechanical Prophylaxis of Venous Thrombosis. Surg., Gynec. & Obst., 1940, 71: 307.
16. GIUS, J. A. Postoperative Atelectasis and Related Pulmonary Complications: Collective Review. Internat. Abstr. Surg., 1940, 71: 65.
17. GRAHAM, E. A. Lowering the Mortality after Operations on the Biliary Tract. Illinois M. J., 1931, 60: 196.
18. HAWKINS, T. L. A Safer Technique in Cholecystectomy. J.-Lancet, 1939, 59: 47.
19. HEUER, G. J. Surgical Aspects of Acute Cholecystitis. Ann. Surg., 1937, 105: 758.
20. HEWITT, H. W. Liver Deaths Following Surgery of the Gall Bladder. J. Michigan State M. Soc., 1935, 34: 421.
21. HEYD, C. G. Liver Deaths and Complications of Gall Bladder Surgery. South. Surgeon, 1937, 3: 183.

21a. Idem. Factors of Mortality in 4,000 Operations Upon the External Biliary System. Ann. Surg., 1940, 111: 820.
22. HINTON, J. W. Hepatodiaphragmatic Adhesions as a Cause of Upper Abdominal Pain. J. Am. M. Ass., 1940, 95: 1744.
23. HOKE, C. C. Factors of Safety in Gall Bladder Surgery. J. Oklahoma State M. Ass., 1936, 29: 358.
24. JACOBI, H. G. Jaundice, New York State J. M., 1940, p. 1218.
24a. JOHNSON, J., RAVDIN, I. S., VARS, H. N., and ZINTEL, H. A. The Effect of Diet on Composition of the Liver in the Presence of Obstruction of the Common Bile Duct. Arch. Surg., 1940, 40: 1104.
25. JONES, T. E. Common Duct Injuries; causation and repair. J. Internat. Coll. Surg., 1939, 2: 206.
26. JUDD, E. S. Diseases of the Biliary Tract. Surg. Clin. North Am., 1935, 15: 1073.
27. LAHEY, F. H. The Present Management of Biliary Tract Disease. Surg. Clin. North Am., 1932, 12: 549.
28. Idem. Strictures of the Common and Hepatic Ducts. Ann. Surg., 1937, 105: 765.
29. MCWHORTER, G. L. Critical Points in Cholecystectomy. Surg. Clin. North Am., 1934, 14: 893.
30. MEYER, K. A., and STEIGMANN, F. Surgical Jaundice; diagnostic considerations. Surg., Gynec. & Obst., 1938, 67: 640.
31. PALMER, D. W. Pre-Operative Pathology in its Relation to Postoperative Gall Bladder Deaths. Ohio State M. J., 1934, 30: 293.
32. RAVDIN, I. S. The Problems of Gall Bladder Disease. Utah M. J., 1937, 2: 7.
33. RAVDIN, I. S., and FRAZIER, W. D. The Advantages of Gradual Decompression Following Complete Common Duct Obstruction. Surg., Gynec. & Obst., 1937, 65: 11.
34. Idem. Pre-operative Preparation of Patients with Cholecystitis and Hepatic Insufficiency. Surg. Clin. North Am., 1937, 17: 1753.
35. RAVDIN, RHOADS, FRAZIER, and ULIN. The Effect of Recent Advances in Biliary Physiology on the Mortality Following Operation for Common Duct Obstruction. Surgery, 1938, 3: 805.
36. Idem. Surgical Diseases of the Extrahepatic Bile Ducts. New England J. Med., 1939, 220: 326.
37. SANDRINI, G. Anomalie Congenite delle Vie Biliare. Clin. Chir., 1940, 16: 227. (Congenital Anomalies of the Biliary Tract, abstracted by Michael De Bakey, Internat. Abstr. Surg., 1940, 71: 262.
38. SUTTON, J. E., JR. Acute Postoperative Necrosis of the Liver. Am. J. M. Sc., 1936, 192: 219.
39. WALTERS, W. Surgery of the Gall Bladder. Proc. Staff Meet. Mayo Clin., 1939, 14: 773.
40. Idem. Strictures and Injuries of the Bile Ducts. J. Am. M. Ass., 1939, 113: 209.
41. WATSON, C. J. Regurgitation Jaundice. J. Am. M. Ass., 1940, 114: 2427.
42. WHIPPLE, A. O. Therapy of Nonmalignant Biliary Tract Lesions. Am. J. Digest. Dis., 1935, 2: 44.
43. Idem. Surgical Treatment of Carcinoma of Ampullary Region and Head of Pancreas. Am. J. Surg., 1938, 40: 260.
44. WRIGHT, R. D. Pre-operative Treatment of Biliary Obstruction. Australian & New Zealand J. Surg., 1933, 2: 392.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Pérez Fontana, V., Castiglioni Alonso, J. C., and Castiglioni Alonso, H.: The Pathogenesis and Therapy of Adamantinomas. A New Surgical Procedure (Consideraciones sobre la patogenia y la terapéutica de los adamantinomas. Nuevo procedimiento quirúrgico). *An. Fac. de med. de Montevideo*, 1940, 25: 875.

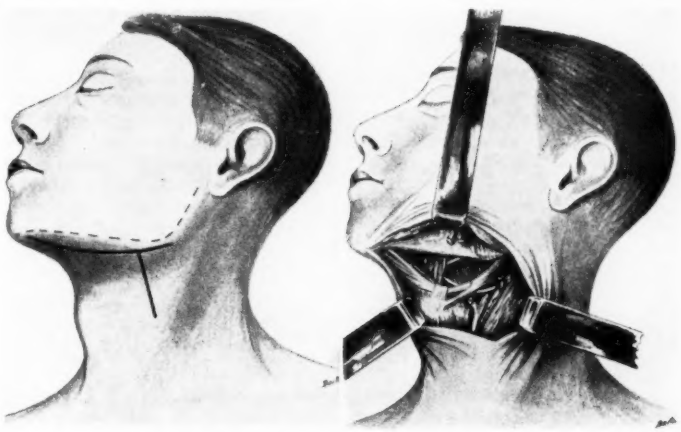
That adamantinomas develop at the site of implanted third molars is a known fact, but the presence of a molar within the nucleus of the tumor is a rare occurrence. Medical history lists only 3 such cases: one cited by Bayer in 1884, another by Hildebrand in 1893, and the third by Ollier in 1915.

Adamantinomas present a characteristic macroscopic aspect: a tumor with honeycombed appearance, multilocular, showing cavities traversed by small trabeculæ. The interior of the cavities is filled with a fluid, either serous or mucous, of yellowish or reddish color. The structure of the adamantinomas shows distinct stages of evolution, from solid to cystic forms, with intermediary mixed, or semisolid, semicystic types. Histologically, adamantinomas present three types, viz.: scaly, plexiform, and glandular. The stroma may be dense or slack.

In the 4 cases reported by the authors a perfect correlation existed between the histological type of the stroma and the tumorous evolution. The therapeutic means employed are both physical and surgical. Physical therapy consists of cauterization, electrocoagulation, and radium. The latter, however, has been practically discarded since practice revealed that radium does not act effectively upon the cells of adamantinomas. Electrocoagulation is recommended because its results are good. There is no relapse and neo-formation of the bone is obtained, but maxillary deformation is a serious obstacle. Surgical treatment is most generally used, with either partial or total extirpation of the maxilla. The authors give a brief historical survey of the surgical methods employed.

Their own procedure is a two-stage operation. The first stage consists of local anesthesia with novocaine (½ per cent) and incision of the skin from the maxillary angle to the external border of the anterior ventriculus of the musculus digastricus. Perpendicularly from the middle of this incision another section of 3 cm. in length is made which reaches to the anterior border of the external cleidomastoid muscle. Extirpation of the submaxillary gland and of the ganglions of that region follows. The external carotid artery is ligated from beneath the digastric muscle. The region is then tamponated with iodoformized gauze and the skin flaps are sutured over the gauze.

The second stage comprises regional anesthesia of the inferior maxillary and lingual nerve, also anesthesia of the suprahyoid region. The neck wound is reopened, the gauze is removed, and the wound is washed carefully. The operative region is protected with warm compresses. The incisor on the affected side is extracted and the mucosa of the mouth is perforated; with a swift curve the entire contour of the bone is exposed, the lower lip being loosened and



Figs. 1 and 2. First stage of intervention.

Figs. 3 and 4. Second stage, from five to nine days after first stage.

the anterior muscular insertions being separated. A Gigli saw is used on the inferior maxilla near the symphysis, and after protecting the lip, the operator sections the bone close to the middle line. With the extreme anterior of the sectioned maxilla displaced toward the cervical incision, it is firmly grasped with a *davier* of Farabeuf and the maxilla is trepanned. Once the maxilla is separated from the muscle the mucosa of the mouth is sectioned to expose the coronoid apophysis which is sectioned from below the insertion of the temporal muscle. The maxilla, now held only by the temporomaxillary joint, is grasped and the condylus is extirpated. Several blood vessels are ligated. Suture of the buccal mucosa follows, and the skin flaps are replaced and joined. A gauze drain is left at the posterior end of the incision. The oral cavity is washed daily, and the nose disinfected. The drain at the neck is removed after the third day. This surgical intervention eliminates operative risks and assures satisfactory functional results.

HILDA H. WHEELER.

Roux-Berger, J. L.: Mixed Tumors of the Parotid Gland (Tumeurs mixtes de la parotide). *Presse méd.*, Par., 1940, 48: 971.

Roux-Berger has found in his clinical experience that mixed tumors of the parotid gland, often considered benign, very frequently show malignant characteristics when the patient is first seen by the surgeon. This malignancy remains localized and the satellite glands are not invaded. There are no clinical signs of the malignant change at first, and often not for a long time. For this reason, the author maintains that when a tumor of the parotid gland is operable, radical operation should be done without biopsy. Radical operation consists in total parotidectomy, not enucleation of the tumor. Enucleation is almost invariably followed by recurrence, as all malignant tissue is not removed by this procedure.

Total parotidectomy, it is true, is a more difficult operation, as it requires a larger incision, and almost always involves some injury to the facial nerve. The lower branch of the facial nerve must usually be sacrificed; only occasionally can it be conserved. The upper branch is usually not involved. Much, however, depends on the site of the tumor; if it is situated high up, in front of the mastoid, total facial paralysis may result from the radical operation. Radical operation is necessary in mixed tumors of the parotid gland, because such tumors are not radiosensitive and radiotherapy is not effective.

Seven illustrative cases of tumor of the parotid gland are reported; a study of these cases shows the following facts which support the author's claim that total parotidectomy is indicated in cases of mixed tumor of the parotid gland:

1. Determination of the nature of the tumor may be difficult even on histological examination of a few sections.

2. Diagnosis as to whether the capsule is invaded or not is impossible on clinical findings; there is often a discrepancy between the clinical signs and the degree of malignancy of the tumor; the satellite glands are rarely invaded.

3. Mixed tumors, although of a malignant nature, develop slowly; facial paralysis is a late symptom even in carcinoma, but pain, however slight, in the region of the facial nerve is a "disquieting" symptom, appearing earlier than paralysis.

4. Radiotherapy and enucleation are found to be ineffective as they are followed by recurrence.

ALICE M. MEYERS.

EYE

Aird, R. B.: Experimental Exophthalmos and Associated Myopathy Induced by the Thyrotropic Extract. *Arch. Ophth.*, 1940, 24: 1167.

In this article, the evidence suggests that exophthalmos is related to the thyrotropic hormone of the anterior lobe of the pituitary body. The pathological changes found in cases of exophthalmic goiter in human beings and the early changes found in experi-

mental exophthalmos are edematous. If proper endocrine adjustment fails to occur after thyroidectomy in human patients, the exophthalmos may continue to progress, and in the late malignant form a degenerative and fibrotic myopathy occurs which may be simulated in experimental exophthalmos by prolonged injections of thyrotropic extract.

The exophthalmos experimentally produced by injections of the extracts of the anterior lobe of the pituitary body was caused by the thyrotropic fraction. The exophthalmos developed in the refractory period following the acute thyrotoxicosis produced by the action of the thyrotropic principle on the thyroid gland and progressed slowly in an irregular manner. After several months of injection, the exophthalmos was found to persist in spite of discontinuance of the injections, narcosis, or death.

Myopathy of the extra-ocular muscles was observed in the guinea pigs in which exophthalmos developed after injection of the extract. This change was sufficient to account for the degree of exophthalmos observed as well as its permanence following prolonged treatment. Other satisfactory explanations for the exophthalmos were not found. Qualitatively, the experimental myopathy was consistent with the changes found in the extra-ocular muscles of human patients afflicted with malignant exophthalmos. LESLIE L. MCCOY, M.D.

Castroviejo, R.: Keratoplasty. *Am. J. Ophth.*, 1941, 24: 1.

The status of keratoplasty in 1932 was summarized by the author in the following conclusions:

The transplant must be taken from the same individual (autoplasty) or from individuals of the same species (homoplasty). Heterotransplants invariably become opaque.

Material can be obtained from living patients who have lesions which require enucleation, but whose corneas are normal, or from cadavers of adults or infants shortly after death. If it is possible to obtain them, eyes of young persons are more suitable for the operation.

The implant, after it has been dissected, can be preserved in dry gauze for immediate transplantation, or in different liquids, such as physiological solution of sodium chloride or hemolyzed serum, in which case it is not necessary to act so expeditiously. The sooner the transplantation is performed after the implant has been dissected from the eye, the less danger there will be of degeneration of the finer structures, such as the endothelium.

Total keratoplasty can be employed in exceptional cases when it is not possible to perform other methods of operation. This, at best, offers only temporary improvement of vision, for the implant invariably becomes opaque from secondary glaucoma or phthisis bulbi.

Lamellar keratoplasty is applicable in cases in which lesions are very superficial. Superficial lesions rarely extend over the whole surface of the cornea; when they are that extensive, they may make this type of operation necessary for visual purposes. Usually, a less complicated operation, such as iridectomy, would serve the same purpose. The necessary proliferation of connective tissue in the place corresponding to the base of the cicatrix contributes to the formation of a certain degree of haziness of the implant which it is impossible to eliminate.

Circumscribed, penetrating keratoplasty produces the best permanent results, and is the only method that offers hope.

Scissors, forceps, and sutures traumatize the implant and favor its opacification.

Transplants must correspond exactly with the defect. It is absolutely necessary to have perfect coaptation of the edges of the transplant with the edges of the cornea of the host. This cannot be obtained by the use of knives and scissors, and requires the aid of some mechanical device which will solve the problem of size of the transplant in relation to the defect in the cornea of the host.

The trephine used to cut the full thickness of the cornea, as in the method of Von Hippel, or the superficial layers only, finishing the incision of the deeper layers with scissors, as in the method of Thomas, has solved the problem of size and form of the transplant.

The transplant must be held in position with the help of sutures. These should not be inserted in the transplant itself, but in the conjunctiva, as in the methods of Elschnig and Zirm, or with cross stitches in the cornea, as in the technique of Thomas.

When operating according to the method of Von Hippel, the pupil must be contracted fully in order to avoid injury to the lens, and it must be completely dilated when operating by the method of Thomas, to avoid anterior synechiæ.

Local anesthesia is to be preferred to general anesthesia because the latter exposes the patient to postoperative vomiting, which threatens the success of the operation.

Good results have been obtained by Elschnig, with the use of a trephine of the same size for the donor and for the host, but Thomas advised the use of a slightly smaller trephine for the donor than for the host. LESLIE L. MCCOY, M.D.

Castroviejo, R.: Keratoplasty. *Am. J. Ophth.*, 1941, 24: 139.

Corneal transplantation is a feasible and practical surgical procedure when a suitable technique is employed. The operation can be mastered by the well trained ophthalmologist, but requires a delicacy and accuracy of technique that can be attained only by practice. Before operating upon human eyes it is advisable for the surgeon to perform corneal transplantations in animals, rabbits being the most suitable. In this regard, individual adaptability to a special technique plays an important rôle. Those who have become acquainted with a certain operation may find it difficult to change to another technique which gives good results in the hands of other colleagues. As in any other field of surgery, each technique has its advantages and disadvantages,

and it is by extensive research made by many persons that one may state which technique gives the highest percentage of good results or which is specially suited for individual cases. Of all the published techniques of partial penetrating corneal transplantation, the author believes that his method of the square corneal graft incorporates more advantages and fewer disadvantages than any other technique.

Autokeratoplasties will give as successful results as homokeratoplasties when the graft is obtained from the fellow eye. However, autotransplantations by transposition or rotation give inferior results, and should be employed only when it is impossible to obtain material for homotransplantation.

Donor's material may be obtained from enucleated eyes with normal corneas, from the eyes of the stillborn, from infants dying shortly after birth, and from eyes of cadavers. These eyes should be as fresh as possible to prevent autolytic changes.

The problem of preserving enucleated eyes in various solutions and in a moist chamber is discussed in detail.

Four new instruments are described only to indicate their inadequacies after clinical trial.

LESLIE L. MCCOY, M.D.

NOSE AND SINUSES

Bilchick, E. B.: Diseases of the Sphenoid Sinus, with the Report of a Case of Cyst of the Sphenoid Sinus. *Arch. Otolaryngol.*, 1940, 32: 1031.

The sphenoid sinus is the most posterior and the least accessible of the nasal accessory sinuses. The anatomical situation, as well as the close proximity of the sinus to many vital and vulnerable structures, has hampered the knowledge of associated abnormalities, and has aroused in many otolaryngologists well justified caution in exploration. This article concerns itself with the clinical pathology and symptomatology, especially as they are related to the neighboring structures. The subject of retrobulbar neuritis is discussed, and a case of cyst of the sphenoid sinus with visual complications is reported.

At birth the sphenoid sinus is only a faint depression in the cancellous tissue of the sphenoid body; at the third year it is the size of a pea; and at the seventh year it can really be made out as a sinus. The sinus borders on the orbit, the optic nerve and its tracts, the third, fourth, and sixth nerves, the middle turbinate, nasal septum, ethmoid sinus, nasopharynx, carotid artery, sphenopalatine ganglion, pituitary gland, meninges, and brain.

The pathology of the sphenoid sinus concerns chiefly acute, subacute, and chronic infections, as well as osteomyelitis, neoplastic disease, and obstructions of the ostium. The normal sphenoid sinus is lined by a thin, delicate epithelium, which may become much thickened and even polypoid as a result of infection. Acute purulent infection of the sphenoid sinus alone is a rare condition. Acute purulent sphenoiditis is almost invariably a concomitant of acute purulent pansinusitis and may result in osteomyelitis and meningitis. Acute exacerbations of a chronic infection are commonly encountered. Chronic sphenoid infections usually result in thickened membrane, together with fibrosis, hyperplasia, and often osteitis; polyps may form; the secretion is usually scanty. Primary neoplasms are rare. Secondary neoplastic involvement is frequent as an extension from the brain, pituitary gland, nasopharynx, and adjacent sinuses. Cysts have been reported occasionally. The clinical symptoms of sphenoid sinusitis differ from sinusitis of the remaining accessory sinuses in that the location of the pain is different, the findings are fewer, the discharge is more elusive, and the complications are more varied.

The pain is usually frontal, occipital, or just behind the eye. It may, however, be referred to the mouth at the junction of the soft palate and the anterior tonsillar pillar, to the vertex, or to the mastoid process. The onset of pain may be sudden or gradual. It may be dull, throbbing, pounding, sickening, stabbing, or burning. When complications ensue there may be visual disturbances or paralyses. In cases of acute purulent infection, meningitis or cavernous-sinus thrombosis may result. Examination may show little of importance. If secretion is seen behind the posterior end of the middle turbinate, on the posterior end of the middle turbinate, in the spheno-ethmoid recess, or around the sphenoid ostium, sphenoiditis is suggested. Roentgenograms are of material assistance in the diagnosis.

Consideration of the differential diagnosis of sphenoiditis brings one into many obscure fields. Intracranial tumors and other lesions, especially of the pituitary gland, vascular aneurysms, migraine headaches, trigeminal neuralgia, multiple sclerosis, endocrine disorders, and hysteria are only a few of the more important conditions which must be differentiated from sphenoid disease.

The conservative management of sphenoid sinusitis includes dietary and prophylactic measures, the use of vitamins, especially A and B_1, diathermy, nasal shrinkage, nasal irrigations, suction irrigation, displacement by iodized oil or ephedrine, and measures to open the posterior nares, including partial resection of the middle turbinate and submucuos resection of the nasal septum. The sphenoid sinus may be irrigated with a cannula, or the anterior wall may be punctured with a trocar and irrigation performed with a cannula. The operative procedures are especially indicated in cases of asthma, bronchiectasis, and retrobulbar and optic neuritis. Here, the operative procedures include removal of the anterior wall and perhaps the floor of the sphenoid sinus.

In discussing the battleground of the ophthalmologists and the otolaryngologists—that of visual disturbances due to sinusitis, particularly retrobulbar neuritis and optic neuritis—it is important to differentiate these two. The weight of opinion at present does not favor operation on the sphenoid

sinus for retrobulbar neuritis, but in many cases optic neuritis has been shown to be due to sphenoidal sinusitis. It is the author's opinion that when the sphenoid sinus shows disease, or when no other cause can be found, optic neuritis should be an indication for sphenoidectomy. NOAH D. FABRICANT, M.D.

PHARYNX

Iglauer, S.: Anatomicopathological Studies of Retropharyngeal (Peripharyngeal) Abscess. *Arch. Otolaryngol.*, 1941, 33: 31.

From the standpoint of anatomy, as well as from that of pathology, it seems justifiable to Iglauer to assume that a simple "retropharyngeal" abscess enters and remains localized in the peripharyngeal space. This is in accord with the clinical course of an uncomplicated abscess. Should the abscess rupture out of the peripharyngeal space, it might enter the postvisceral space and produce a true retropharyngeal abscess; on the other hand, should it perforate laterally, it might erode the carotid artery or give rise to a parapharyngeal abscess. It seems justifiable, therefore, to discontinue the use of the general term "retropharyngeal" abscess and substitute the term "peripharyngeal" for a simple, uncomplicated abscess situated in the posterolateral wall of the pharynx (mural).

The term "retropharyngeal" should be applied to an extramural median abscess originating from the median lymph nodes or occurring in the postvisceral space following injury through the pharynx or extension from an adjacent abscess. Abscesses originating from caries of the cervical vertebræ belong in another category, namely "prevertebral abscess," situated in the prevertebral muscle space. Such a classification leads to a better understanding of the underlying pathological changes, to more accurate diagnosis, and to rational surgical procedures in the treatment of infections behind the pharynx.

Two cases of peripharyngeal abscess with gross and microscopic observations at autopsy are reported. NOAH D. FABRICANT, M.D.

Putney, F. J., and Fry, K. E.: Retropharyngeal Lipoma. *Ann. Otol., Rhinol. & Laryngol.*, 1940, 49: 967.

Lipomas may develop in any part of the body where adipose tissue is located, yet their occurrence in and around the pharynx is observed very infrequently. Lipomas in this region are usually grouped as pharyngeal growths. This designation is not wholly satisfactory, for although retropharyngeal growths are found in the pharynx they originate outside of the pharyngeal cavity and mucous membrane. Retropharyngeal lipomas should therefore be classified under a separate anatomical heading from pharyngeal tumors.

The symptoms are produced by an interference with deglutition or respiration. Tumors in this locality are rarely noticed except when the symptoms become marked and the swelling is large. A feeling of a "lump in the throat" may be the first indication of any abnormality. Dyspnea, especially in a prone position, is frequently noticed because of the bulging forward of the posterior pharyngeal wall over the aperture of the larynx. Noisy breathing while asleep is a common complaint. Speech changes such as thickness or indistinctness may be early symptoms. As the tumor increases in size, progressive dysphagia develops. Inability to propel a bolus of food beyond the pharynx, and lodgment of food at that site are noticed. Weight loss may occur from lack of sufficient nutrition and sleep.

On examination of the pharynx the interval between the soft palate and posterior pharyngeal wall is greatly diminished, and a smooth swelling of the posterior wall can be seen. The swelling appears smooth, non-ulcerated, and may be located in the midline, but more often predominates on one side. The enlargement may extend from the nasopharynx to the hypopharynx, and a view of the larynx is often obscured by the overhanging mass. On palpation the tumor is moderately firm and compressible. When the tumor is large there is usually a mass present in the neck, more commonly unilateral, with an indefinite outline and of soft consistency. Lobulations can rarely be distinguished.

Retropharyngeal lipoma must be differentiated from a malignant tumor or abscess in this locality. Treatment is surgical extirpation, preferably by an approach through the neck. The technique of removal is relatively easy because the mass is sharply defined from the surrounding tissue and shells out readily. An incision along the anterior border of the sternomastoid muscle provides adequate exposure. The tumor may extend from the base of the skull to the apex of the lung and may lie in close approximation to the carotid sheath. It is not necessary to ligate the external carotid artery preliminary to operation. The danger of severe hemorrhage is remote if the incision affords a view of the important structures in the neck.

Although a larger number of lipomas of the pharynx have been reported, only 15 cases could be found in the literature, to which 2 cases are added by the authors. NOAH D. FABRICANT, M.D.

NECK

Scarcello, N. S., and Goodale, R. H.: Struma Lymphomatosa. *New England J. Med.*, 1941, 224: 60.

Struma lymphomatosa is a lymphoid goiter; it was first described by Hashimoto in 1912. Hashimoto considered this disease a separate entity, not to be confused with Riedel's disease, the essential clinical feature of which is a widespread involvement of the extrathyroid tissues in a diffuse sclerosis apparently originating in part of the thyroid gland.

Ewing, in 1922, came to the conclusion that Hashimoto had described the earlier stages, and Riedel the later stages of the same disease. A survey of the literature reveals that while many authors hold

to this view, numerous others have expressed the opinion that the diseases are distinct entities. The present evidence would appear to support the latter idea.

The cause of these diseases remains unknown, and there is some difference of opinion as to whether or not the cases can be diagnosed clinically. Characteristic findings of Hashimoto's struma are: its preponderance in women of from forty-five to sixty years of age, a tendency toward myxedema, involvement of all parts of the thyroid but nothing outside of it, the absence of woody hardness of the goiter, mild pressure effects, and its characteristic histological structure. The diagnostic features of Riedel's disease are: its occurrence in young men and women, the little tendency toward myxedema, unilateral involvement, extension to the extrathyroid structures, the intensely hard goiter, grave pressure effects, and the dense scar tissue as shown histologically.

Surgical intervention in cases of struma lymphomatosa is contraindicated, especially in the cases associated with hypothyroidism. In cases of hyperthyroidism, only enough gland should be removed to relieve the pressure symptoms or to establish a diagnosis, thus ruling out cancer. Basal metabolic rates should be determined frequently, and whenever signs of hypothyroidism are evident, thyroid medication should be instituted. Good results have been reported with x-ray and radium therapy.

A case of Hashimoto's disease occurring in a young woman twenty-six years of age with symptoms of hyperthyroidism is reported. Following subtotal thyroidectomy, the patient developed a progressive myxedema of increasing severity. She was followed up clinically until her death, thirteen years later. At that time thyroid tissue obtained at autopsy was compared with that removed at operation, with practically identical histological findings.

S. Lloyd Teitelman, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Munro, D., and Maltbig, G. L.: Extradural Hemorrhage. *Ann. Surg.*, 1941, 113: 192.

With an experience based on 44 cases of extradural hemorrhage, the authors believe that the "classical" description of such a lesion—initial loss of consciousness, lucid interval, secondary unconsciousness, clear cerebrospinal fluid—is usually wrong and misleading in actual practice.

While the cause of such a lesion is trauma to the head, such hematomas are yet a rare complication of such trauma, occurring in only 3 per cent of their cases of such injury. The bleeding is either arterial or venous, frequently the latter, contrary to popular belief. A unilateral dilated pupil is not always present, but when it is it may usually be taken to indicate an ipsilateral clot. The authors would consider the history of the accident of equal or greater importance than most of the resulting neurological signs, many of which are shifting and unreliable. Extradural hematoma is to be differentiated from cerebral laceration and contusion, localized cerebral edema, subdural hematoma, depressed skull fracture, and intracerebral hematoma; but actual diagnostic exploratory trephination may be necessary to establish a correct diagnosis.

Treatment consists of making a craniectomy in the temporal bone large enough to remove the clot and allow accurate control of the bleeding vessels. These should be clipped or tied, not coagulated. The dura is then opened widely to allow for cerebral decompression and the wound is closed with rubber drains in place. Lumbar punctures and judicious dehydration methods are used postoperatively to control intracranial pressure increases. Patients with extradural hemorrhage require immediate care, close teamwork on the part of everyone in the operating room, and intelligent after-care. Under the best of circumstances they are in an extremely critical condition and all too often the outcome is fatal.

JOHN MARTIN, M.D.

Poe, D. L.: Sphenotemporal Lobe Abscess with an Analysis of Little Known Clinical Symptoms. *Laryngoscope*, 1941, 51: 87.

This presentation of a case of sphenotemporal-lobe abscess emphasizes the following highlights of consideration to establish the side and site of operation. The patient was a ten-year-old boy with a history of bilateral otitis media of six years' duration. Deep coma had been present for fourteen hours. The pupils were irregular and dilated, with the left larger and fixed. Two diopters of choking of the right optic nerve head and four diopters of choking of the left, with hemorrhage on the left disc, were found. There was bilateral spasticity, with a questionable Babinski sign. Drowsiness and sensory aphasia indicated that this was a case of sphenotemporal-lobe abscess secondary to chronic otitis media on the dominant side of the brain, which in this right-handed boy was on the left side.

At operation (mastoidectomy) there was no avenue of infection visible extending from the surgically exposed area to the brain. With exposure of the middle and posterior cranial fossæ, there was evidence of increased intracranial pressure, but of no other pathology. Palpation gave the impression of a deep, fluctuating mass. A needle passed 4.5 cm. toward the inferior ventricular horn evacuated 46 c.cm. of purulent fluid. A Mosher basket drain was introduced and packed with gauze which was changed frequently. The Mosher basket was removed after thirty-five days. Recovery was uneventful. Cultural examination showed the streptococcus hemolyticus.

Experimental, clinical, and pathological evidence corroborates Marburg, Takase, and Anglade in their notation that the temporal lobes are the seat of or are concerned with emotions or "affective tonus." The symptoms that we may expect as a result of serious injury to the temporal lobe on the dominant side of the brain occur because of damaged uncus, hippocampus, optic radiations, and Wernicke and Gerstmann areas. The symptoms resulting from impairment of each of these areas are described in detail. They may occur in various degrees of intensity or in many combinations.

The best results of surgical interference in brain abscess are achieved after encapsulation occurs. The two chief problems in treating brain abscess are the diagnosis of the abscess and the decision of when to operate.

JOHN L. LINDQUIST, M.D.

Schwartz, H. G., and O'Leary, J. L.: Section of the Spinothalamic Tract in the Medulla with Observations on the Pathway for Pain. *Surgery*, 1941, 9: 183.

Schwartz sectioned the spinothalamic tract at the junction of the middle and lower thirds of the inferior olive for relief of intractable pain. Careful sensory examination was recorded prior to operation. During operation the sensory changes which occurred in different parts of the body were correlated with the increasing depths of incision. Observations were also made upon partial section of the descending spinal tract of the trigeminal nerve. The operative technique is described. The patient expired on the second postoperative day, and autopsy with detailed study of the brain was made. The diagram (Fig. 1) illustrates the sensory changes. Outline drawings illustrate the extent of the surgical lesions in the right spinothalamic tract.

There was evidence that the mandibular fibers of the trigeminal nerve were injured. The observations

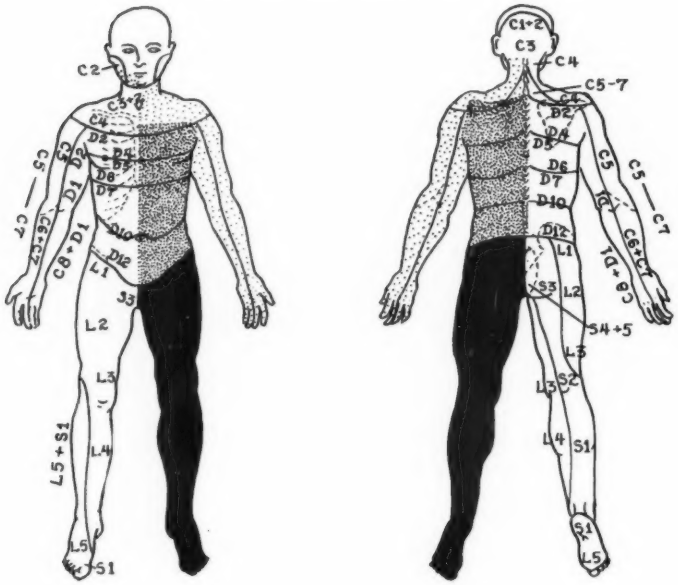


Fig. 1. Illustrates the results of the postoperative sensory examination which was checked repeatedly.

here support the premise that in the brain stem, as in the cord, fibers from the lower dermatomes lie dorsolaterally while those from the upper segments lie ventromedially. JOHN L. LINDQUIST, M.D.

Živković, V.: A New Surgical Treatment for Trigeminal Neuralgia (Eine neue chirurgische Methode bei Trigeminusneuralgie). *Med. Pregl.*, 1940, 15: 71.

A short historical review is given concerning the various forms of treatment of trigeminal neuralgia: from the peripheral alcohol injection of Pitres and Verzar, the peripheral branch resection of Hartley, and Haertel's type of alcohol injection, to the operation of Frazier and Spiller. Dandy's new method of sectioning the sensory root of the trigeminal nerve close to the brain stem differs essentially from that of Frazier only in the matter of anatomical approach.

In Olivecrona's clinic in Stockholm they have become convinced that the pain-bearing fibers come from the bulbospinal tract, and on the basis of this fact Sjöqvist arrived at the idea of sectioning this tract within the brain stem. The first operation of this type was done in 1937, and by 1938 17 operations had been done by this method. Before such an operation an accurate study of facial sensation is necessary, for which purpose in this particular clinic both sides of the face are mapped into square millimeters by a special marking device. Each square is then tested for sensation and the result is accurately recorded. The operation is done under part local and part general anesthesia. A small incision, from 6 to 8 cm. long, is made in the suboccipital area on the involved side. Removal of the arch of the atlas is not necessary. The cerebellar tonsil and hemisphere are carefully elevated so that one can accurately visualize the olive and restiform body, to-

gether with the tenth, eleventh, and twelfth nerves. The section of the tract should be made in the plane between the upper and lower halves of the olive. The cut is from 3 to 4 mm. long and from 3 to 3.5 mm. deep.

Possible complications are injury to the vagus, with paralysis of the recurrent nerve. Only 2 cases resulted in failure, probably because the tract was not accurately sectioned, and these were later treated successfully by the Frazier type of operation.

(Lavric). John Martin, M.D.

PERIPHERAL NERVES

Kraus, H., and Reisner, H.: Results of Treatment of Peripheral Nerve Wounds with Particular Consideration of the Gunshot Wounds of the Years 1919, 1927, and 1934 (Behandlungsergebnisse von Verletzungen peripherer Nerven mit besonderer Beruecksichtigung der Schussverletzungen der Jahre 1919, 1927 und 1934). *Arch. f. klin. Chir.*, 1940, 199: 318.

The authors report on an investigation of 66 cases of treated peripheral nerve injuries for the years from 1927 to 1938. Of these, 40 were operated upon primarily and 10, secondarily. Nerve sutures were accomplished bloodlessly, usually under local anesthesia, and only the finest of silk suture material was used. In the cases of incomplete section of the nerve, suture was done in the same general way. In compounded fractures the nerve suture was done during wound repair, but in closed or non-compounded fractures the necessary nerve sutures were postponed until healing of the fractures. Neurolysis was done perineurally, never endoneurally.

In injuries of the radial nerve both movement and sensation were restored; movement was best restored in the median nerve, sensation in the ulnar nerve. Perineural suture gave good results in the incomplete nerve sections. An especially impressive case of laceration of the median and ulnar nerves at the elbow, with excellent healing results, is reported. In cases in which mobility had been restored fatigue was experienced easily. Only in a minor percentage of the cases was a loss of dissociated sensory perception confirmed, although disturbances of temperature perception were usually somewhat more widespread than those of touch and pain. The state of the weather always exerted a strong influence on the production of unpleasant sensations (paresthesias). Trophic disturbances were rare; they were more commonly seen with concurrent arterial damage. So far as healing expectations are concerned, multiple nerve injuries, especially those of the median and ulnar nerves, are as favorable as single injuries. Wound infection does not adversely influence healing expectation to any great degree. Secondary nerve suture does not give so good a result as does primary suture, especially if there is quite a long time intervening before suture is finally accomplished. Also, secondary suture is much more frequently attended by eventual vasomotor-trophic disturbances. The earlier intervention occurred the better result was obtained from neurolysis, and the results were especially good in the cases of radial palsy following fracture of the humerus. They would have been still better had endoneurolysis been done in the cases with edema of the radial nerve. Trophic disturbances remained in 41 per cent of the cases examined.

One cannot doubt the value of electrophysical after-care; and the maintenance of motion of the joint and avoidance of contractures appear to be of greatest importance. Sixteen cases which were treated conservatively, and approximately 75 per cent of the cases given electrophysical after-care, showed a 75 per cent recovery and a 25 per cent improvement, except for the cases of peroneal paralysis, in which the results of treatment are always difficult to evaluate. Of 19 gunshot nerve injuries, 11 were treated operatively, 3 of them being operated upon twice. The results in gunshot wounds are more unfavorable than those in the usual open wounds, presumably because suppuration persists for a longer time. Therefore, in such cases primary suture must be avoided. In such wounds also the sciatic and peroneal nerves show the poorest results.

(Max Budde). John Martin, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Pou Orfila, J: Mastopathies and Benign Tumors of the Breast; Treatment (Mastopatías y tumores mamarios benignos. Conducta a seguir). *Bol. oficial Liga uruguaya contra el cáncer*, 1939, 14: 6.

In the pathology of the breast there are two kinds of disease to be considered—the functional and organic. The best treatment for the former group is hormone treatment with ovarian extract as the leading component and extract of the anterior lobe of the hypophysis and thyroid extract as supplements.

In chronic cystic mastopathy hormone therapy may be tried, but the treatment of choice is partial or total mastectomy, according to the findings in the case. The possibility of malignant degeneration must be borne in mind in chronic cystic mastopathy. The best preventive of such degeneration is partial or total mastectomy.

If possible, a differentiation should be made between benign and malignant tumors of the breast, but there is no definite line of demarcation between benignancy and malignancy. Sometimes the differentiation can be made comparatively easily by clinical examination alone and sometimes it can hardly be made with the aid of the most careful histological examination. Clinical diagnosis should, however, always be supplemented by histological examination. In cases that are doubtful clinically, a biopsy should be made during the operation.

Sometimes there are histological forms intermediate between benign and malignant pictures in which the prognosis is doubtful. In the breast these forms are particularly important. There are also cases in which benign and malignant forms are combined.

In diagnosis the surgeon should collaborate with the histologist and carefully weigh the clinical data and the results of histological examination based on sufficient biopsy material.

In benign lesions of the breast roentgen treatment is indicated if the patient refuses operation or if operation involves particularly serious risks. As a general rule, surgery is to be preferred when possible. For the extirpation of benign tumors four types of incision are to be recommended: perimammary, supero-internal, periareolar, and ample biconvex transverse.

As a general rule circumscribed cystic mastopathies and fibro-adenomas of the breast should be treated by partial mastectomy, diffuse cystic mastopathies by total mastectomy, and intracanalicular papillomas by simple local extirpation of the affected duct. AUDREY G. MORGAN, M.D.

Eggers, C., DeCholnoky, T., and Jessup, D. S. D.: Cancer of the Breast. *Ann. Surg.*, 1941, 113: 321.

An analysis of 505 cases of breast cancer is presented from the Skin and Cancer Unit of the New York Post-Graduate Hospital. One hundred and eleven of the patients, or 22 per cent, had metastases which were internal or were irremovable and, therefore, were inoperable. Three hundred and ninety-four were considered operable. Of these, 116, or 23 per cent, came for consultation only, leaving 278, or 55 per cent, upon whom this report is based.

Preliminary excision of the tumor is advised in radical operations to avoid manipulation of the growth and the spread of cancer cells during operation.

By means of the two tests at our disposal for judging the efficacy of the radical operation for cancer of the breast—longevity and local recurrence—we may conclude that a carefully performed operation is successful in curing the disease locally.

Complications and sequelæ are presented under the different headings of bilateral involvement; supraclavicular involvement; the significance of bleeding from the nipple and other discharges; ulcerated breast carcinoma; local recurrence; and chronic edema of the arm. Cases with serous and other discharges may be regarded as probably benign and treatment for relief instituted. They should, however, be kept under observation. Knowing that a large percentage of patients with bleeding nipples have carcinoma, its clinical significance should be stressed. If the bleeding persists it is important that some operative procedure be employed to determine the source of the bleeding. A simple ablation may be indicated.

Five-year arrest of the disease was obtained in 55.6 per cent of the cases without lymph-node involvement, and in 21.2 per cent of those with lymph-node involvement. Ten-year arrest was obtained in 36.1 per cent of the cases without lymph-node involvement, and in 13.1 per cent of those with lymph-node involvement. These cases, though they show a relatively low percentage of "cures," give quite favorable statistics when viewed in the light of the poor clinical condition of the patients, and the fact that they were operated upon by 34 different surgeons. JOSEPH K. NARAT, M.D.

Peck, W. S., Ransom, H. K., and Hodges, F. J.: Treatment of Advanced and Recurrent Carcinoma of the Breast. *Am. J. Roentgenol.*, 1940, 44: 866.

This article is devoted largely to the consideration of the treatment of patients afflicted with incurable mammary carcinoma. In cases in which the extent of the lesion, the presence of distant metastases, or other causes contraindicate surgery, irradiation is usually the only feasible method of treatment and prolongation of life and alleviation of suffering are ordinarily all that can be expected from it. With a view toward emphasizing the importance of providing care in such cases, the authors have re-

viewed the case records of 920 consecutive patients admitted to the University Hospital from 1931 to 1938. Only palliative treatment could be offered to 430 of this number when they were first seen.

In dealing with cases of advanced carcinoma of the breast the procedures of choice as determined in Neoplasm Conferences based upon the clinical experience provided by the group of patients under consideration are presented in detail. For purposes of discussion the lesions are classified and tabulated as follows:

1. Local lesions (untreated)
   a. Breast contains multiple carcinomatous masses (inoperable)
   b. "Inflammatory type" of carcinoma
   c. Slowly growing carcinoma with contraction of breast
   d. Ulcerating carcinoma
   e. Bilateral carcinomatous involvement of the breasts
2. Axillary and supraclavicular metastases (untreated)
   a. Large but movable axillary metastases
   b. Fixed axillary metastases
   c. Supraclavicular metastases
3. Remote metastases
   a. Metastatic lesions in bone
   b. Pulmonary, liver, and other remote metastases
4. Local recurrences
   a. Postoperative
      (1) Multiple subcutaneous nodules
      (2) Recurrences in the scar
      (3) "Inflammatory type" of recurrence in the chest wall
   b. Postirradiation

The preferable procedures in connection with each of the conditions mentioned are indicated. Consideration is also given to castration by irradiation if the patient is menstruating. Among the conclusions reached it is stated that irradiation is the most effective single agent in dealing with advanced and recurrent breast cancer. ADOLPH HARTUNG, M.D.

TRACHEA, LUNGS, AND PLEURA

Nicolosi, G.: New Orientations in the Treatment of Thoracopulmonary Injuries (Nuovi orientamenti nella terapia delle ferite toraco-polmonari). *Policlin.*, Rome, 1940, 47: sez. chir. 395.

Perforating wounds of the chest with injuries of the lungs should, in Nicolosi's opinion, be treated conservatively, unless a surgical intervention is indicated by special complications.

It is important to immobilize the damaged lung, which can be done completely with artificial pneumothorax. However, this is impracticable or dangerous if pleural adhesions exist, if the other lung is infected or injured, or if the wound channel extends into the extrathoracic parts.

Latteri, in 1932, introduced alcoholization of the intercostal nerves. The correspondent parts of the thorax are hereby immobilized, and the movements of the lung, though not fully prevented, are sufficiently reduced to facilitate the fixing of the edges of the wound, as well as the stopping of the hemorrhage. Pneumothorax certainly has a more radical instantaneous effect, but no one can predict how long it will last in the individual case. Sometimes it is absorbed rapidly, and upon the expansion of the lung the wound may again be torn open. The immobility of the thorax produced by alcoholization, however, lasts at least three months. Moreover, the alcoholization can be executed on both sides at the same time.

Immediately after the alcoholization the pain recedes and respiration is easier; soon the actual bleeding stops, and secondary bleeding is prevented.

The removal of the hemothorax is generally not advisable because the latter tamponizes the bleeding lung. Of course, if the hematoma is large enough to disturb the respiration to a great extent, it has to be partially emptied. The desirable slow absorption of the hemothorax is facilitated rather than hampered by alcoholization.

A pneumothorax caused by the injury itself has to be emptied only in case of pleural adhesions with the danger of embolism or hemorrhage.

The development of a deleterious universal emphysema will be prevented by alcoholization. Paralyzing of the intercostal nerves is the ideal treatment for fractures of the ribs.

From 5 to 9 single nerves can be alcoholized in one stage.

Many soldiers with perforating wounds of the chest bleed to death while being transported. It is impossible to have the necessary apparatus for applying a pneumothorax everywhere behind the front line, but it is possible everywhere to resort to intercostal alcoholization by means of a common syringe, a usual anesthetic, and a little alcohol.

NELDA CASSUTO.

Ross, J. M.: Hemorrhage Into the Lungs in Cases of Death Due to Trauma. *Brit. M. J.*, 1941, 1: 79.

In this paper, based on post-mortem examination of many cases of chest injury, a comparison is made between peace-time and war-time injuries. To a large extent war-time injuries of the chest and lungs caused by flying missiles, impact damage, compression, and asphyxia when bodies are buried under débris are comparable to peace-time injuries of the chest sustained by automobile accident victims or industrial cases. However, during this war a new clinical entity has emerged which may well be called "hemorrhagic pulmonary concussion" with minor or absent injury to the chest wall. These cases are due to the proximity of the patient to detonation of high explosive shells. The salient post-mortem feature is extensive bilateral intrapulmonary hemorrhage, which is widespread and consists of intense capillary congestion with bleeding into the walls of the small bronchioles and distention of the air vesicles and respiratory bronchioles. There is usually

no clotting of the blood and in most cases the patients have died within two or three days.

J. E. TREMAINE, M.D.

Paine, J. R.: Studies in the Experimental Production of Pulmonary Emphysema. *J. Thoracic Surg.*, 1940, 10: 150.

The author reviews the many theories in regard to the development of pulmonary emphysema and the experimental work that has been done. It is evident that emphysema can be produced by (1) some type of obstruction to the passage of air through the tracheobronchial tree; (2) increase in the space occupied by functioning lung tissue; and (3) decrease in oxygen tension of the air breathed.

The author inserted into the trachea of dogs a valve-like mechanism which obstructed inspiration and in other dogs a mechanism which obstructed expiration, and in a series of controls he inserted a mechanism without the valve so that neither expiration nor inspiration was obstructed.

He also conducted experiments on dogs in which the thoracic cage was enlarged by removal of the costal cartilages or by reefing of the diaphragm.

His results showed that expiratory obstruction produced the gross and microscopic changes of emphysema, and that inspiratory obstruction produced emphysema.

The operation of removing costal cartilages was not successful in enlarging the thoracic cage, but the operation of reefing the diaphragm did increase the thoracic capacity and the animals so treated developed the gross and histological evidence of emphysema.

JULIAN A. MOORE, M.D.

Debré, R., Lamy, M., and Marie, J.: Congenital Air Cysts of the Lung and Emphysema from Bronchial Obstruction in Children (Kystes gazeux congénitaux du poumon et emphysème par obstruction bronchique chez l'enfant). *Presse méd.*, Par., 1940, 48: 913.

The authors state that congenital cysts of the lung were formerly believed to be extremely rare and incompatible with life, but it has recently been shown that this condition occurs more often than is commonly realized and that it can be present for many years. Congenital air cyst of the lung is now a well known clinical entity. Emphysema from bronchial obstruction, although known to the anatomicopathologist since Laënnec's time, is less frequently recognized by the clinician. These two conditions are seen as intrapulmonary gas pockets both by the radiologist and the clinician, which makes the differential diagnosis extremely difficult. On the basis of their recent studies the authors are of the opinion that these two conditions have been frequently confused clinically and congenital lung cyst has sometimes been erroneously diagnosed as emphysema from bronchial obstruction.

In this article the authors attempt to differentiate between the two diseases. Severe dyspnea is the most characteristic clinical feature of congenital cyst of the lung occurring in infants several weeks of age. Physical signs are similar to those of pneumothorax if the cyst is large and include exaggerated breathing, absence of breath sounds, and displacement of the heart and mediastinum toward the uninvolved side. Radiography of large cysts reveals an image similar to a pneumothorax on superficial examination. However, on closer inspection the picture is suggestive of a cyst: there is no hilus shadow even after decompression and the contours of the gaseous cavity are finely outlined along the diaphragm, heart, and borders of the mediastinum. Solitary cysts of smaller size are round and regular and may be more easily outlined by partial filling with an opaque fluid. Multiple cysts appear as a series of cavities juxtaposed or oval, occupying part of one or both lungs. These cysts may remain unchanged for a long time. However, it is possible for the cyst to open into a large bronchus or into the pleural cavity; several cysts might fuse into a large sac; there might be an intracystic hemorrhage manifested by consequent hemoptosis; or the cyst might suppurate.

Emphysema following bronchial obstruction may be caused by a foreign body or by an endobronchial or extrinsic tumor as in carcinoma or adenopathy. The etiology can be determined by clinical study, roentgenography and lipiodol examination, and bronchoscopy. Complete obstruction is associated with atelectasis. If the obstruction occurs at a large bronchus or a lobar bronchus, the condition affects the corresponding pulmonary lobes and is known as lobar emphysema. When the obstruction occurs at a small bronchus, the emphysema is limited and forms a kind of bubble in the pulmonary parenchyma. The authors call this bullous emphysema.

In lobar emphysema the most constant symptom is dyspnea, continuous or paroxysmal in character, occurring as a single attack or in repeated attacks. Physical signs are those of a pneumothorax. Radiography reveals exaggerated transparency of the affected lobe, an increase in the surface of the lobe, a lowering and partial fixation of the diaphragmatic sac, and an exaggerated excursion of the diaphragm on the healthy side. The heart and mediastinum are attracted to the uninvolved side during expiration. Radiography may also indicate the cause of obstruction. Lipiodol instillation of the bronchus usually indicates an arrest at the level of obstruction. Bronchoscopy is informative of the state of the bronchi, indicates the obstacle, and is suggestive of the type of therapy to be instituted.

Bullous emphysema appears in the pulmonary parenchyma as a large clear bubble but is smaller than the voluminous lobar emphysema. The cause of bronchial obliteration may be a foreign body, a ganglion mass, or an inflammatory lesion of the bronchial canal. It usually occurs as a complication of an acute pneumopathy. There is rarely any evidence of cavitation or partial pneumothorax. The lesion is revealed only by roentgenography as a clear, round, regular or polylobular bubble with definite contour. The bulla appears either in the

interior or in the vicinity of the opaque focus of the primary pulmonary lesion. The area rarely increases in size and usually there is rapid disappearance following elimination of the obstructing bronchial secretions.

The authors emphasize the frequent difficulty in differentiating between congenital air cysts and bullous emphysema of the lung. In discussing the distinguishing characteristics they stress the necessity of considering the onset, clinical course, and the possibility of bronchial obstruction. They conclude that by careful study one can distinguish air cyst of the lung, a congenital developmental abnormality, from emphysema due to obstruction (both lobar and bullous), a more or less transient mechanical difficulty of air circulation in the lung.

MICHAEL DEBAKEY, M.D.

Lieberman, L. M., Hodes, P. J., and Leopold, S.S.: Roentgen Therapy of Experimental Lobar Pneumonia in Dogs. *Am. J. M. Sc.*, 1941, 201: 92.

The authors have reviewed the published reports of the use of roentgen therapy in acute and unresolved pneumonia. They have also reviewed the literature in regard to the mechanism of the effects of irradiation in inflammatory conditions. They observed that the roentgen therapy of lobar pneumonia had little background of animal investigation and believed that experimental studies should be made if the method were to be satisfactorily evaluated.

Lobar pneumonia was produced in anesthetized dogs by the introduction of 1 c.cm. of potato-starch paste containing 0.06 c.cm. of sedimented, virulent pneumococci, into the bronchus of the lower lobe of the lung desired. Experimental pneumonia was induced in 45 dogs, 26 of which were treated with roentgen rays and 19 of which served as controls. None of the control animals in this series survived. Blood-stream invasion occurred in 5 of the 25 dogs in which blood cultures were taken. The treated dogs were divided into three groups. The dogs in Group 1 were treated with rays generated at 80 kv. and 5 ma., filtered through 5 mm. of aluminum at a T.S.D. of 30 cm. A 20 by 20 cm. portal was directed laterally into the affected lung. In this group there were 10 irradiated and 10 control animals. All of these dogs died, the period of survival in the control series being three and four-tenths days, that in the treated series, four and five-tenths days.

Group 2 consisted of 4 animals, 3 of which were treated with roentgen rays generated at 135 kv. and 8 ma., filtered through 0.25 mm. of copper and 1 mm. of aluminum at a T.S.D. of 30 mm. One of the treated animals recovered.

The 13 irradiated dogs in Group 3 were treated with rays generated at 200 kv. and 20 ma., filtered through 0.5 mm. of copper and 1 mm. of aluminum at a T.S.D. of 50 cm., the portal, 20 by 20 cm., being directed laterally into the affected lung. There were 8 control animals in this series. Three of the controls and 5 of the treated dogs had positive blood cultures. The average survival period in the control series was two and one-tenth days. The average survival period in the irradiated animals which died was eight and five-tenths days. Five of the treated animals survived.

The microscopic appearance of the lung was studied and it was found that the degree of congestion and hemorrhage was essentially the same in the irradiated animals as in the controls. Edema and atelectasis were less marked in the irradiated group. There was a relative increase in round-cell infiltration associated with a decrease in the neutrophils. In general, the pneumonic process in the treated animals seemed to have progressed beyond the acute stage which characterized the control group.

The authors believe that their results justify the conclusion that when sufficient dosage of irradiation is used in the treatment of experimental lobar pneumonia in dogs there is definite evidence of a trend toward survival. HAROLD C. OCHSNER, M.D.

Rolland, J., and Tsoutis, N. G.: Curative Action of Partial Thoracoplasties of the Apex on Purulent Effusions Resulting from Ineffective Pneumothorax (Effet curateur sur les épanchements purulents des pneumothorax inefficaces, des thoracoplasties partielles du sommet). *Presse méd.*, Par., 1940, 48: 922.

The inefficacy of a pneumothorax is proved by the persistence of expectoration containing bacilli, in spite of the collapse of the lung. The first thing to do is to determine whether there is any infection on the other side that is keeping up the expectoration. If not, in all probability the expectoration is caused by the presence of adhesive bands. Of course, the only effective way of treating the complications of pneumothorax is to prevent them, and now, with the Jacobœus method, there is no longer any excuse for an ineffective pneumothorax.

However, if a pneumothorax proves ineffective, or not sufficiently effective, an early pleuroscopy should be carried out, and if it shows that the pneumothorax cannot be improved upon there should be no hesitation in performing operation.

Two cases are described in which an ineffective pneumothorax was treated surgically. In the first case there was an excavated lesion of the upper lobe adherent to the apex. In the second there was a small cavity in a stump of lung that was flattened in a band against the mediastinum. Both patients had expectoration containing bacilli and in both cases there was purulent effusion which reformed quickly after evacuation. In the first case a partial upper thoracoplasty was performed with resection of the posterior arches of the first four ribs near the transverse processes; the operation was performed in one stage. In the second case vertebral disarticulation of the first four ribs was performed with resection of the transverse processes, also in one stage. The author emphasizes the value of the latter operation, which has been condemned as useless and dangerous

by some operators. He points out that there is no such thing as a "standard" rib resection; each operation should be made to fit the case, as a dress is cut to fit the wearer.

In both cases the lesions collapsed and the bacilli disappeared, as was to be expected, but surprisingly enough, the effusions became serous and then stopped also.

These cases show that the purulent pleurisy, practically always tuberculous, which develops in ineffective pneumothorax comes from a lesion in the lung that is being pulled on by the adhesive band. No amount of draining of the pleura will do any good as long as the effusion is being kept up by the unhealed lung lesion. Pleurotomy would have condemned these patients to prolonged if not perpetual drainage. The only logical treatment was to collapse the infected lung. AUDREY G. MORGAN, M.D.

Hall, W. C.: The Origin of Tumors Occurring in the Apex of the Lung. *Am. J. Roentgenol.*, 1940, 44: 838.

In 1924 Pancoast reported 3 apical lung tumors. In 1932, when he reviewed these cases and 4 more, he gave to them the name "superior pulmonary sulcus tumor." He laid down 5 criteria for the diagnosis of this tumor. These were: (1) location at the thoracic inlet with roentgen demonstration of a small homogeneous shadow in the pulmonary apex; (2) pain in the shoulder, often radiating down the arm, associated with atrophy of various muscles of the upper extremity on the side of the lesion; (3) Horner's syndrome on the involved side; (4) localized rib destruction limited to the first three ribs, and occasionally associated with vertebral infiltration; and (5) death occurring as a result of a comparatively trivial growth without demonstrable roentgen evidence of metastasis. The author has reviewed the literature and finds the weight of evidence to indicate that most apical tumors are primary in the lung but that other primary and metastatic tumors may occur in this region; many of these lesions may simulate the tumors described by Pancoast.

Five cases of apical lung tumor which produced signs and symptoms similar to those described by Pancoast are reviewed. The first patient had a large carcinoma of the lower third of the esophagus with metastasis to the mediastinal lymph nodes, the right apex, the right posterior chest wall, and the upper thoracic vertebræ. In the second case autopsy showed a small scirrhous carcinoma of the stomach with metastasis to the left adrenal gland and to the apex of the lung. In the fourth case, a large round fibrous growth, found in the apex, measured approximately 10 cm. in diameter and involved the pleura, the ribs, and the lateral aspects of the upper dorsal vertebræ. The histological characteristics of this tumor were those of primary carcinoma of an atypical variety. In the fifth case, a soft tissue lesion in the right apex, associated with destruction of the transverse processes and pedicles of the seventh cervical and first thoracic vertebræ and of the first portion of the first rib on the right side, involved other ribs and vertebræ, in addition to the skull and pelvis. On needle biopsy the tumor was found to be a malignant metastasizing chromaffinoma. Three months later, however, carcinoma of the thyroid was found at operation.

The author concludes that there is no specific tumor in the apex of the lung which produces the characteristic signs and symptoms previously described by Pancoast. Many types of cancer may produce these changes. HAROLD C. OCHSNER, M.D.

Leddy, E. T., and Moersch, H. J.: Roentgen Therapy for Bronchiogenic Carcinoma. *J. Am. M. Ass.*, 1940, 115: 2239.

The authors compared the results obtained from roentgen therapy in a group of 125 cases of proved primary bronchiogenic carcinoma with the results in another group of 125 proved cases in which neither roentgen therapy nor any other form of therapy was employed. They regarded a proved case as one in which tissue from the tumor on microscopic examination showed the presence of carcinoma.

In all cases in their study there was microscopic confirmation of the clinical diagnosis. All of the 250 patients considered in this study were examined by the same group of clinicians and roentgenologists, and the treatment was given by the same group of radiologists. Many more than 125 patients received roentgen therapy for primary carcinoma of the bronchus, but since there were only 125 who did not receive roentgen therapy, the authors thought it advisable for purposes of comparison to limit the group who did receive such therapy to the same number as those who did not.

Primary carcinoma of the bronchus is usually insidious in its onset, and it is often difficult to distinguish it from other forms of pulmonary disease. It may, therefore, be overlooked because of the fact that the symptoms at the onset may blend imperceptibly with the clinical symptoms that may exist as a result of other pulmonary disease. In certain instances, however, there is a history that the patient apparently enjoyed perfect health and then suffered a sudden onset of symptoms such as pulmonary hemorrhage or severe paroxysms of cough.

From the standpoint of symptomatology, there was no difference whatever so far as the clinical course was concerned between the two groups in the series.

It is noteworthy that there was a rather low incidence of peripheral tumors, such as those originating near the pleura and those of the "Pancoast" type. This may be attributable in part to the fact that in the majority of the cases in the study the diagnosis was based on microscopic examination of tissue obtained through the bronchoscope. Thus, many cases in which the lesion was situated in the periphery of the lung and in which the diagnosis was not established until autopsy were not included in this study.

To avoid all controversy over classification the authors divided the tumors according to their obvious structure, that is, adenomatous or epitheliomatous, and subdivided them according to their index of malignancy as determined by Broders personally. Such a classification is simple, clear, not ambiguous, and easy to use; it seemed to the authors to be more advantageous than other more elaborate and perhaps more confusing classifications.

Outstanding is the high incidence of tumors of the highest grades of malignancy. In fact, of the 250 tumors the authors considered, 212 were of the most malignant type. There is, however, nothing remarkably different in regard to the distribution of tumors according to their index of malignancy whether in the treated or the untreated groups. As a matter of fact, the index of malignancy played no rôle whatever in the decision as to whether a given tumor was or was not suitable for roentgen therapy.

For the purpose of record it can be stated that there was 1 case of hemangio-endothelioma of the trachea. One of the 8 adenocarcinomas, Grade 1, occurred in the trachea, 1 in the left upper lobe, and 2 each in the right main bronchus, the right middle lobe, and the right lower lobe, respectively.

To evaluate roentgen therapy for bronchiogenic carcinoma, the authors presented an analysis of the results which they obtained in a group of 125 proved cases of bronchiogenic carcinoma in which the treatment had been given by various roentgenological methods.

Ninety-nine patients were in the terminal stages of the disease when encountered, but even in those who did receive some treatment, little was accomplished because 37 died within four months.

Three patients lived a year or more without treatment after histological proof of the diagnosis. As a matter of fact, all 3 of these patients had roentgen therapy elsewhere, but were listed as untreated because they did not receive treatment at the clinic.

Twelve patients had incomplete or "placebo" treatment, and 2 others had roentgen therapy of moderate voltage. All 14 patients, who for all practical purposes were untreated, followed the course of the untreated patients.

Regardless of the amount of roentgen therapy which they actually received, 25 of these 125 patients lived for at least one year after treatment. In general, adenocarcinoma, Grade 1, has the most favorable prognosis of all these lesions, and, as a whole, patients with adenocarcinoma do better than those with epithelioma. Fifteen of these 25 patients had adenocarcinoma. Of these 15 lesions, 4 were Grade 1, 2 were Grade 2, 4 were Grade 3, and 5 were Grade 4. Ten of these 25 patients had squamous-cell epithelioma. Of these 10 lesions, 5 were Grade 3 and 5 were Grade 4.

In the series of 250 cases of proved bronchiogenic carcinoma, the prognosis was poor because of the advanced stage of the disease at which a correct diagnosis was made. Nevertheless, the authors' results showed that roentgen therapy not only is an excellent method of palliation but also that it has produced so-called cures. They, therefore, think that any patient who is not in too precarious a physical condition should have at least one course of roentgen therapy; otherwise, his life expectancy is, at most, one year. On the other hand, 25 patients in the series lived from one to twelve years after roentgen therapy. The data are inconclusive but it seems to the authors that, in general, adenocarcinoma is a more favorable type of tumor than epithelioma. The question of the best method of treating bronchiogenic carcinoma with roentgen rays, they thought, had better remain unanswered for the present.

HEART AND PERICARDIUM

Cutler, E. C., and Hoerr, S. O.: Total Thyroidectomy for Heart Disease. *Ann. Surg.*, 1941, 113: 245.

The authors have presented a detailed report of 57 consecutive cases of total thyroidectomy for heart disease during 1932, 1933, and 1934. There were 5 postoperative deaths. There are now 12 survivors in the group of 32 patients with angina pectoris, and 4 in the group of 25 who presented congestive heart failure.

From their experience, the authors believe that in a selected group of patients with intractable angina pectoris, total thyroidectomy is a worth-while therapeutic measure and is not too great a risk. However, in other types of heart disease, the results are not gratifying. JULIAN A. MOORE, M.D.

ESOPHAGUS AND MEDIASTINUM

Freeman, E. B.: Conservative Treatment of Achalasia. *Arch. Surg.*, 1940, 41: 1141.

The success of conservative treatment of achalasia depends on complete dilatation of the cardia. This procedure is best accomplished in one of five ways: (1) dilatation with mercury-filled bougies; (2) dilatation with bougies passed through the esophagoscope; (3) dilatation with the combined mercury bougie and pneumatic dilator; (4) dilatation with a pneumatic or hydrostatic dilator; and (5) dilatation under fluoroscopic control. It has been definitely proved that the dilated esophagus never regains its normal tone. However, the obstruction can be sufficiently overcome in most cases so that the contents of the esophagus passes freely through the cardia. Of these various methods, the author believes that the pneumatic or hydrostatic dilator is the most satisfactory. He has used it for many years and obtained satisfactory results. Air instead of water may be used to distend the dilating bag. The success of the treatment depends entirely on complete dilatation of the cardia. This author believes that this can not be accomplished by the mercury-filled bougies or by the passage of bougies through an esophagoscope because of the fact that neither of these procedures completely dilates the lower end of the esophagus. Complete dilatation can be accomplished only by an

instrument with a dilating bag sufficiently large to dilate the cardia completely. Of all the different types of instruments that he has used, this author believes the one adapted best for the purpose is the Plummer cardiospasm dilator.

J. DANIEL WILLEMS, M.D.

MISCELLANEOUS

Rolland, J., and Tsoutis, N. G.: Pulmonary Abscess Following a Mega-Esophagus, Operated upon in One Stage after the Creation of an Artificial Pleural Symphysis; Cure (Abcès du poumon consécutif à un méga-œsophage, opéré en un seul temps après création de symphyse pleurale artificielle; guérison). *Presse méd.*, Par., 1940, 48: 1024.

Rolland and Tsoutis report a case in which the diagnosis of pulmonary abscess was made on the basis of the clinical symptoms and confirmed by roentgenological examination. According to the roentgen findings, the pulmonary abscess was located in the median lobe of the right lung, close to the anterior thoracic wall. The roentgenogram also showed a peculiar image in the region of the posterior mediastinum; with the use of the opaque meal, this was shown to be a mega-esophagus. There was definite stasis in the esophagus; it seemed probable that when the patient lay down, some of the contents were aspirated into the bronchi and this was the cause of the pulmonary abscess.

In the operative treatment of the pulmonary abscess, the authors employed the method that they have previously described: drainage and elimination of the abscess cavity in a one-stage operation after the creation of an artificial pleural symphysis by injection of a sclerosing solution into the pleural cavity. In this case the injection was followed by a myositis of the pectoral muscle (pectoralis major); this was the first time this complication occurred in the authors' experience. It was not serious and subsided promptly under treatment; however, it prolonged the period of pre-operative observation somewhat. Usually five days are sufficient to establish the local pleural symphysis after the injection of the sclerosing solution, but in this case twelve days elapsed before the myositis subsided. The injection of sclerosing solution (quinine and urea hydrochloride) had been made in the fourth intercostal space, near the site of the abscess. At operation the fourth rib was resected, and the parietal pleura was found to be closely adherent to the cortex of the lung. A sufficient portion of the lung was resected with the electric cutting current to eliminate the abscess cavity; the walls were treated by electrocoagulation. The authors have found that this procedure favors healing, probably because of its effect on the blood vessels. The patient made a good recovery and was relieved of symptoms at the time of his discharge.

ALICE M. MEYERS.

SURGERY OF THE ABDOMEN

GASTRO-INTESTINAL TRACT

Gray, J. S., Wieczorowski, E., and Ivy, A. C.: Inhibition of the Gastric Secretion in Man with Urogastrone. *Am. J. Digest. Dis.*, 1940, 7: 513.

Experimentally, an active principle, "enterogastrone," can be extracted from intestinal mucosa, which will inhibit gastric secretion and motility when injected parenterally.

Attention has been directed in the literature to the urine as a possible source of the gastric inhibitory principle or principles. It has been reported that commercial extracts of human pregnancy urine containing the chorionic gonadotropic hormone were potent in preventing or delaying the onset of experimental ulcers in dogs. In addition, an inhibitory factor has been reported to be present in the urine of patients with peptic ulcer, pernicious anemia, and gastric carcinoma, in the urine of normal dogs and dogs subjected to gastrectomy or duodenectomy, and in the gastric juice of patients with pernicious anemia or gastric carcinoma.

The question of specificity arose when it was found that urine extracts contain a pyrogen, or fever-producing substance, because fever depresses gastric secretion. However, extracts were prepared from human urine which were entirely free of pyrogenic impurity. When it was found that the gastric inhibitory factor was distinct from pyrogen, the gonadotropic hormones, and apparently the ulcer-preventive factor, it was given the name "urogastrone." This term was coined to distinguish the urinary factor from "enterogastrone," until the two had been proved to be identical.

In regard to the source of urogastrone, it has been found that when the small intestine of dogs is removed urogastrone disappears from the urine. It has been found recently that a control operation consisting of identical procedures with the exception that the small intestine was not removed from the abdominal cavity does not cause urogastrone to disappear from the urine. These observations suggest that urogastrone comes from the small intestine.

Obviously, urogastrone, as well as enterogastrone, has therapeutic promise in that it may provide a practical method for the control of gastric secretion. With this idea in mind the effects of a purified preparation of urogastrone on gastric secretion in a group of human subjects were investigated by the authors.

The subcutaneous administration of a potent preparation of urogastrone to 9 human subjects significantly reduced the gastric secretory response to histamine with regard to the volume of gastric juice, its acidity, and the output of free acid. This inhibitory action was obtained with no other observed effects than a mild local erythema and tenderness at the site of injection.

SAMUEL H. KLEIN, M.D.

Stoppani, F., and Matli', G.: Gastric Peristalsis and Solid Ingesta. Roentgen Findings in the normal Stomach and after Operation (Peristalsi gastrica e ingesti solidi. Rilievi radiologici nello stomaco normale e operato). *Radiol. med.*, 1941, 28: 15.

In a stomach containing liquid barium it is impossible to observe the movements of the mucosa and determine what part they play in the mixing and expulsion of the contents. The authors therefore decided to try the use of solid ingesta, making use of the olives ordinarily used for diagnostic purposes and filling them with barium. In the normal stomach the mucous membrane formed grooves along which these olives passed in single file to the pylorus where they underwent a movement of rotation and one by one passed through the pylorus. This peristaltic movement which forced them along the greater curvature to the pylorus was performed almost entirely by the mucosa of the greater curvature.

In stomachs on which gastro-enterostomy had been performed the olives progressed toward the anastomosis in single file, as they did in the normal stomach, and when they reached the anastomosis they underwent the same rotation and collected in a figure resembling the petals of a daisy, after which they passed out one by one. These findings are illustrated by roentgenograms. This behavior of the olives seemed to show that remarkable functional adaptation had been established in the resected stomach.

The authors believe that this method of examining the stomach with solid ingesta should be more commonly used, as in some cases it may show better than examination with liquids the functional integrity both of the normal stomach and the stomach that has been operated on. AUDREY G. MORGAN, M.D.

Woldman, E. E.: The Treatment of Massive Gastroduodenal Hemorrhage by the Continuous Administration of Colloidal Aluminum Hydroxide. A Report of 144 Cases. *Am. J. Digest. Dis.*, 1941, 8: 39.

One hundred and forty-four patients with massive hemorrhages resulting from gastric or duodenal ulcer were treated by the continuous administration of colloidal aluminum hydroxide. In this series, there were 3 deaths, or a mortality rate of 2 per cent, as contrasted to a mortality rate of 28 per cent during a similar period at the same hospital, preceding the inauguration of this form of medical treatment.

The continuous administration of colloidal aluminum hydroxide in massive gastric hemorrhage presents certain advantages over other methods of treatment:

1. It is a harmless, non-absorbable astringent which is capable of hastening the formation of a clot.

2. By virtue of its antacid properties it can prevent the digestion of the clot by continuously neutralizing the excess acid in the stomach, without danger of alkalosis.

3. Because it is a gelatinous substance, it has the additional advantage of mechanically protecting the lesion.

4. As the result of continuous administration of colloidal aluminum hydroxide, both day and night, the delicate granulation tissue formed in the process of healing is not destroyed by the accumulation of acid during the night, and thus the lesion is permitted to heal.

This treatment accomplishes a two-fold purpose: it arrests the bleeding and protects the ulcer, to facilitate its healing.

As soon as a patient with melena is admitted to the hospital, a soft nasogastric tube is passed through the nose to the cardiac end of the stomach, and the drip treatment is begun. If hematemesis is present, the patient receives colloidal aluminum hydroxide by mouth every hour until vomiting ceases; then the drip treatment is begun.

These patients receive a soft bland diet every two hours, which is the same as that administered to other patients with peptic ulcer. To induce rest, the hypodermic administration of sodium phenobarbital is preferred to that of morphine, because morphine not only interferes with the normal functioning of the gastro-intestinal tract, but also has the undesirable effect of causing emesis in some instances. Small transfusions, usually of about 250 c.cm. of blood, are given, if indicated.

The technique of administering colloidal aluminum hydroxide by the drip method requires hospitalization of the patient. The colloidal aluminum hydroxide diluted to a 33⅓ per cent suspension is continuously instilled into the stomach through a nasogastric tube, at the rate of about 15 drops each minute, during the night as well as during the day, for ten days. The flow of the drops is regulated and controlled by a special apparatus.

The indwelling nasal catheter was the source of considerable difficulty in some of the early cases. When a small Levin tube was used, the lumen was so small that it would become occluded by particles of food regurgitating back into the tube, or by a thick coating on the walls of the tube of the aluminum hydroxide itself. This, of course, caused cessation of the flow, and necessitated troublesome irrigations of the tube, which corrected the difficulty only temporarily, and therefore had to be repeated frequently. When a large Levin tube was used, many patients complained of soreness in the nose and throat, even when the tube was well lubricated with mineral oil, and frequently they would remove the tube themselves when the discomfort became too great.

These difficulties were overcome by the use of a soft, collapsible, thin rubber tube, about 3/16 inch in diameter, which was passed through the nose into the stomach with the aid of a silkworm-gut suture. This tube has entirely eliminated the difficulties of obstruction of the lumen and discomfort to the patient which were experienced with the Levin tube. The nasogastric tube is passed only as far as the lower end of the esophagus. This precaution eliminates the rare possibility of any danger of trauma to the lesion by the tube.

In the few instances in which patients objected to or could not tolerate the nasogastric tube, the medication was administered by mouth. One ounce of a 33⅓ per cent suspension of colloidal aluminum hydroxide in water was given every hour during the day until the patient retired and thereafter he was awakened every two hours during the night to receive the same dose. Usually, a sedative was administered in the evening, so that the patient fell asleep promptly after being aroused for the medication. With the drip method, of course, the patients rest all night without interruption.

Inasmuch as the astringent action of aluminum hydroxide causes some constipation, mineral oil is given daily, or an enema every other day.

SAMUEL H. KLEIN, M.D.

Nuttall, W. H. C.: Hematemesis from Peptic Ulcer—The Case for Operation; Chronic Gastric Ulcer, Chronic Duodenal Ulcer, Gastrostaxis, Carcinoma of the Stomach. *Lancet*, 1941, 240:35.

"It is a fallacy to estimate the mortality from hemorrhage in peptic ulcer as a percentage of the whole number of the cases irrespective of their severity." The fatal cases are usually those with eroded arteries and the author agrees with Finsterer that in these severe cases it is safer to explore than to wait for further hemorrhages. The author attempts to restate the case for the surgeon with the plea that in the light of his own experience a bolder attitude be taken on the part of the average surgeon with some experience in gastric surgery.

The management outlined is blood transfusion plus a minimum operative procedure. The surgeon should be satisfied *with the arrest of hemorrhage alone*. There is no necessity for the average surgeon to concern himself with any procedure such as gastrectomy, which is directed toward preventing further ulceration, unless the hemorrhage may itself necessitate a resection. The simplest and quickest methods are indicated. The use of clamps or other special apparatus is best avoided when possible. The ulcer is resected by a method of gradual excision with simultaneous suture of the gastric and duodenal wound. The hole in the viscus is never large. Bleeding from the cut edge is diminished and the extravasation of the contents with actual excision is under complete control of the operator from start to finish. The suture is tied on one side before the lumen is opened and stay sutures are held by an assistant which keeps the parts steady and maintains traction. After each snip of the scissors to the right or left of the ulcer the resulting orifice is sewed and the slack of the suture held taut while the next cuts are made, until excision and suture are finally completed.

There were 2 fatalities, 1 from carcinoma of the stomach and 1 from duodenal ulcer, in the series of 18 patients with peptic ulcer and severe hemorrhage.
SAMUEL J. FOGELSON, M.D.

Livingston, E. M., and Pack, G. T.: Surgical Aids to the Intracavitary Treatment and Study of Cancer of the Stomach. *Am. J. Surg.*, 1941, 51: 453.

Operative surgery for stomach cancers is divisible into four types: (1) exploratory surgery (peritoneoscopy; laparotomy); (2) excisional surgery (total gastrectomy, cardiectomy, partial gastrectomy, segmental resection); (3) palliative surgery (gastro-enterostomy, gastrostomy, pyloric exclusion, jejunostomy); and (4) radiation surgery and electrosurgery (combined treatment).

This monograph deals with pioneering activities in the field of combined therapy and endogastric instrumentation. New methods of approach to the gastric lumen, new forms of gastric irradiation, and new types of intraluminal equipment are depicted. Except for oral instruments, such as the flexible gastroscope, which are passed into the stomach by way of the mouth and esophagus, all endogastric studies and therapy are dependent on surgery for their clinical application. Treatment must be either given during the course of an exploratory operation following intraperitoneal exposure of the gastric mucosa, or administered postoperatively by way of a surgically created gastrostomy gooseneck tract. The technique and equipment for endogastric instrumentation and intraventricular irradiation described by the author offer added incentive for further clinical studies in this field. Such physical appliances as an anterior gastroscope or operating televentroscope, multiple-lumened radium applicators, endogastric balloons, electrosurgical biopsy tools, contact x-ray anodes, air-valves for a control of larger gastrostomy fistulas, cameras for photographing in color the gastric mucous membrane and other instruments depicted, now furnish the necessary means for conducting vigorous clinical tests in this domain.

In such a situation certain queries naturally arise. Radiation therapy for gastric cancer has lagged appreciably behind the impressive successes of radiation methods in the control of malignant tumors in

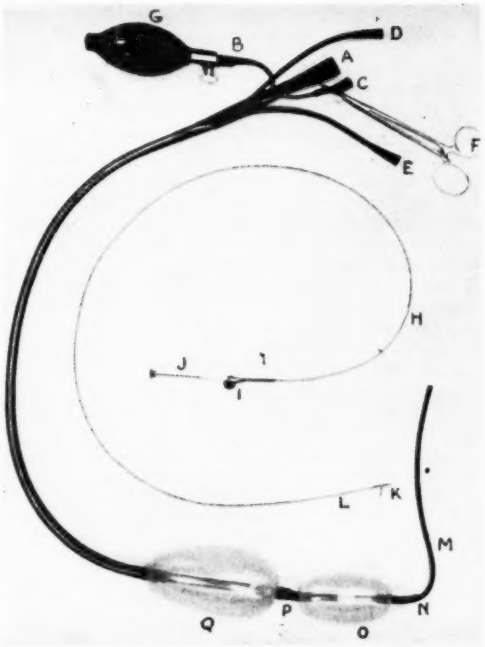


Fig. 2. Details of construction of the multiple-lumened radium applicator for the intracavitary treatment of cancer of the stomach. A, radium channel; B, inflation channel for pyloric balloon; C, inflation channel for the fundic balloon; D, gastric suction channel; E, duodenal feeding channel; F, clamp closing an air-way; G, inflation bulb attached to an air-way; H, the flexible radium core; I, set-screw for stylet; J, the stylet or ejector; K, detachable tip for loading the radium or radon capillary tube; L, site for storage of radioactive tube; M, duodenal feeding tube; N, terminal opening of radium channel; O, pyloric balloon; P, gastric suction opening; Q, fundus balloon.

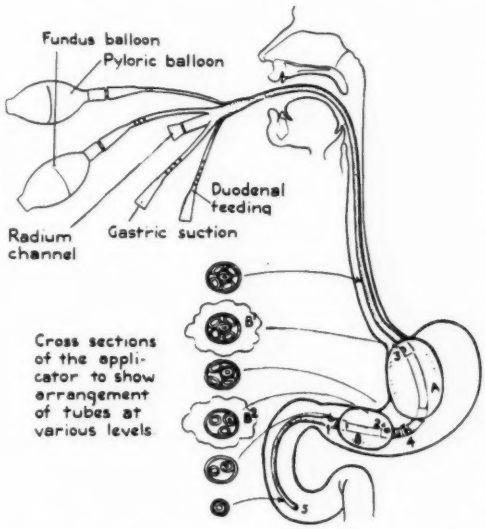


Fig. 1. The Livingston multiple-lumened radium applicator for the intracavitary treatment of cancer of the stomach. A—Fundus balloon. B—Pyloric balloon. 1—Radium channel. 2—Airway to pyloric balloon. 3—Airway to fundus balloon. 4—Gastric suction channel. 5—Duodenal feeding channel (Rings on tubes of hydra-head correspond to numbers.)

Fig. 3. Retrograde insertion of an intracavitary radium applicator. The patient has swallowed a cord which has been brought to the body surface through a Janeway gastrostomy. The radium applicator has been attached to this cord and drawn into position within the stomach. A feeding tube is also *in situ*. Both the feeding tube and the radium applicator have been passed through the central lumen of a gastrostomy air-valve, which locks them in position. Inserts A to D show use of Livingston air-valve. (Courtesy of American Journal of Surgery.)

other organs and sites. There is no record of a single patient with verified gastric carcinoma treated by any form of radiation therapy, without gastrectomy, who has survived treatment by so long as three years. Since unaided external radiation is not adequate to furnish a suitable number of threshold erythema doses for gastric carcinomas, adjuvant intracavitary therapy becomes a prime necessity if definitive cures are to be obtained. Successful intracavitary radiation must deal with far more than the major problem of adequate tissue dosage; it must also provide for maintenance of nutrition, protection of neighboring vital organs, and avoidance of necrosis, perforation, or hemorrhage; yield relief from obstructions to gastric inlet or outlet; and provide for motility difficulties. The radium applicators described by the authors prove capable of delivering in a single treatment as many threshold erythema doses to all parts of the tumor as can now be given by any form of external irradiation in a period of from fifteen to thirty days of uninterrupted daily treatment. With this equipment it now for the first time becomes physically possible to carry routinely the total tissue doses of irradiation for stomach cancer to any level desired.

JOSEPH K. NARAT, M.D.

Viacava, E. P.: Gastrectomy; Its Results (La gastrectomía; sus resultados). *Bol. inst. de clin. quir., Univ. de Buenos Aires*, 1940, 16: 487.

Since Rydiger performed the first gastrectomy in 1885, this operation has been used very extensively in surgery. New techniques have been devised and clinical and roentgen studies have been pursued actively. The author describes and illustrates the different techniques and gives statistics on the immediate and late results. He also discusses the changes in gastric secretion in patients who have undergone this operation, and considers the roentgen study of the stump, illustrating his text with many roentgenograms.

He concludes that gastrectomy marked a decided advance in the surgical treatment of gastroduodenal ulcers, but that its indications will certainly decrease when the cause of these lesions has been discovered. In the meantime it is the operation of choice.

Among the different methods used, those of Pólya and of Hoffmeister and Finsterer show the lowest mortality. Resection, exclusion, and gastrectomy in two stages do not seem to be superior to resection with simple gastro-enterostomy in the treatment of ulcers.

The operative and postoperative complications of the operation may be reduced to a minimum if the surgeon remembers that he is facing a very complex surgical problem which requires a very careful selection of patients, the greatest possible perfection of technique, and the most meticulous pre-operative and postoperative care. The mortality of the operation has decreased in recent years, as has that of all delicate abdominal operations because of perfection of technique and improved care.

The late results of the Pólya and Hoffmeister-Finsterer methods maintain their leading position provided the lesion and the zone of surrounding gastritis are resected.

The secretory and motor changes following the operation show that the stump of the stomach passes through a period of functional adaptation which lasts for a variable length of time and which necessitates great care in diet in order to assure success.

Some patients have anemia after the operation but the author has never seen it severe enough to lead him to doubt the wisdom of his choice of operation. Patients who have undergone gastrectomy may show disturbances of pancreatic function which are manifested by diarrhea, the poor digestion of fats and carbohydrates, and glycosuria. The most serious problem presented by this type of operation is jejunopeptic ulcer which comes as a late complication.

AUDREY G. MORGAN, M.D.

Eggers, C.: Acute Diverticulitis and Sigmoiditis. *Ann. Surg.*, 1941, 113: 15.

This report is based on the cases of 82 patients with symptoms of sufficient severity to warrant surgical consultation. The majority of patients with acute diverticulitis and sigmoiditis recover with conservative treatment, and may guard against recurrence by the regulation of their diet and bowel habits.

Diverticulitis complicated by perforation may present the picture of a spreading peritonitis of doubtful origin, or there may be pain localized in

the left lower quadrant. When the abscess is in the midline or in the pelvis, a positive diagnosis may not be possible until after the abdomen has been opened. When the signs are mild, study and observation are permitted, and a late diagnosis can be reached the same as in uncomplicated cases. In acute surgical emergencies requiring prompt attention, the author advises operation and diagnosis after incision.

In cases of gross perforation, the author advises exteriorization if possible, and resection later. If this is not possible, ample drainage and colostomy above the lesion is the procedure of choice. If the exudate resulting from the perforation has been walled off to form an abscess, early and adequate drainage is essential.

When diverticulitis results in intestinal obstruction the differential diagnosis between diverticulitis and carcinoma is very difficult and sometimes impossible. If the obstruction is acute and apparently complete, prompt operation is indicated, and should be of a palliative nature (cecostomy, colostomy, or first-stage Mikulicz procedure). A differential diagnosis may be possible after subsidence of the acute symptoms, and will influence further treatment.

Gross examination of resected specimens reveals either a normal mucosa or one with redness and superficial erosions, but no ulceration. The lesion is confined to the wall and perisigmoid tissues. Often no diverticula are visible externally. They are small and still intramural. These early diverticula become inflamed, perforate into the wall, and produce a phlegmon which, in turn, produces a tumor mass. An inflamed, fully developed diverticulum is more likely to perforate externally and give rise to peritonitis.

In 34 patients (41.5 per cent) some type of operation was performed. The indications for operation were perforation with abscess or peritonitis, obstruction, persistent pain, recurrent attacks, or the suspicion that carcinoma might be associated with the condition.

Twenty patients (24.4 per cent) developed acute perforation with abscess formation or peritonitis. In 14, a simple drainage operation was done; in 5 others, drainage plus some other procedure was carried out; 1 was not operated upon. The early mortality in this group was 45 per cent. One late death from complications brought the mortality due to perforation to 50 per cent.

Twenty-three other operations were performed by means of exploratory celiotomy, or exploration with separation of adhesions, colostomy, cecostomy, or resection. There were no deaths in this group.

Carcinoma was associated with the diverticulitis in 5 patients, all of whom eventually succumbed to the condition. The total mortality directly traceable to diverticulitis of the sigmoid colon was 16, or 19.5 per cent.

Attention is directed to the seriousness of the condition, and it is stressed that diverticulosis is not an innocuous lesion. Once the condition is recognized, the patient must be warned of possible danger and given instructions in order to avoid complications. HAROLD LAUFMAN, M.D.

Rumbold, L.: Some Factors in a Lowered Mortality Rate for Acute Appendicitis; Analysis of 2,013 Consecutive Cases. *Arch. Surg.*, 1941, 42: 25.

The author presents his third statistical report of the cases of acute appendicitis occurring in the Genesee Hospital, Rochester, New York. All cases were proved instances of acute inflammatory disease of the appendix. They occurred during the period from 1925 through 1938 and were divided into two five-year periods and one four-year period for comparison.

Since 1930, with 133 proved cases of acute appendicitis and a mortality rate of 6.01 per cent, the number of cases in this hospital has increased 25 per cent while the mortality rate decreased yearly. In 1938, there were 199 cases with a death rate of only 0.5 per cent. Certain factors appear to have contributed to the further reduction in mortality. They may be summed up as follows:

Continued education of the public against delay in diagnosis and treatment. Continuous education of physicians to keep them "appendicitis conscious." Pre-operative preparation of the patient who is acutely ill with high fever, high pulse rate, dehydration, and shock. Attempt on the part of the surgeon to evaluate the stage of appendicitis, the choice of anesthetic, and the proper incision. Postoperative care with attention to fluid balance, use of the duodenal tube to combat nausea and vomiting, and avoidance of fluids or food by mouth until restoration of bowel tone has occurred. The patient's condition can apparently be judged by means of daily leucocyte counts and frequent blood-pressure readings. With a marked fall in blood pressure, transfusion may be essential.

The factors credited with the reduced mortality rate are: better postoperative care of the patient, use of the McBurney incision, and closure of all wounds except in cases of well walled-off abscess. In a small series of patients in which the Ochsner delayed treatment had been used, the results appear to show that this treatment has a place in the armamentarium of the surgeon.

JOHN W. NUZUM, M.D.

Hicken, N. F., and Carlquist, J. H.: Primary Appendical Abscesses. *Arch. Surg.*, 1941, 42: 156.

In 528 cases of acute suppurative appendicitis there were 53 primary abscesses (10 per cent). These abscesses were located contiguously to the cecum in at least 75 per cent of the cases, but some were localized in various other regions and were designated as subhepatic, subphrenic, ileocolic, and pelvic abscesses.

The pericecal abscesses were always connected with the appendix, although the appendix may have been difficult to find. Complete disintegration and sloughing of the appendix occurred rarely. Circumcecal abscesses often were multiple or multilocular and in these cases incomplete drainage often result-

ed. Retrocecal abscesses were prone to extend upward to the subhepatic space and occasionally caused ureteritis, pyuria, and other urinary symptoms leading to a mistaken diagnosis of perinephritic abscess.

Pericecal abscesses should be drained through an adequate incision made directly over the tumescence, care being exercised to prevent injury to intervening loops of bowel.

The authors removed the appendix in 39 of 40 cases of pericecal abscesses at the primary operation and believed that by doing so, the morbidity and mortality rates were reduced. In cases of an associated cecitis, difficulty may be encountered in ligating or suturing the stump of the appendix. If this difficulty is encountered, suturing over with omentum or mesentery, or the insertion of a cecostomy tube overcomes the difficulty. If the patient is very toxic, simple drainage alone is indicated, the appendix being removed at a secondary operation.

Subhepatic and subphrenic abscesses occurred by upward extension either through contiguity or the lymphatics. These abscesses occurred usually from eight to ten days after the onset of primary infection or the surgery, with pain in the right chest and right supraclavicular area, increased toxicity, tenderness over the twelfth rib, and a high fixed right diaphragm. Diagnostic aspiration is condemned. Exploration and drainage should be carried out by the posterior extraserous route with resection of the twelfth rib.

Ileocolic abscesses lying mesial to the cecum were particularly dangerous because of their tendency to produce intestinal obstruction, mesenteric thrombophlebitis, segmental gangrene of the bowel, and pylephlebitis. There was also grave danger of generalized peritonitis resulting from spontaneous rupture of the abscess or from injudicious manipulation at operative drainage. Usually, no attempt should be made to remove the appendix at the primary operation.

Pelvic abscesses were readily diagnosed by rectal and pelvic examinations. Many of these abscesses were spontaneously absorbed, but delayed drainage is attended with risks. In the female drainage was best accomplished through the vagina, and in young children and males through the rectum. The abscess was opened with blunt forceps after an incision had been made through the rectal or vaginal wall.

Pylephlebitis and portal thrombosis occurred any time up to six weeks, and was a serious complication. Early exploration, drainage of regional abscesses, and ligation of involved venous radicles combined with intensive chemotherapy, offered the only help.

Pre-operatively, the patient should be prepared by gastric lavage, restoration of fluid balance, and transfusion if indicated, since no immediate emergency exists in cases of appendical abscesses. The authors favor spinal anesthesia as it offers many advantages.

Postoperative therapy is of greatest importance and includes gastric decompression with a Levine tube, parenteral administration of fluids and vitamins, and the use of sedatives and hot fomentations as indicated. Sulfanilamide is advocated in large doses by mouth, subcutaneously, or intramuscularly.

Under the régime described the authors' mortality rate was 1.8 per cent. LUTHER H. WOLFF, M.D.

Carrere, J.: Physiopathology of the Colon Studied by a New Method (Fisiopatología del colon estudiada por un nuevo método). *Arch. argent. de enferm. d. apar. digest.*, 1940, 16: 5.

The intestinal tract of every individual has its own characteristics, and though it may function properly and normally, it may present enormous differences from those of other individuals, particularly regarding anatomy, speed of evacuation, and reflex action. There are many variations in the function of evacuation which are compatible with health.

The author points out the importance of utilizing the ingested food itself as a means of gaining evidence of reflex disturbances provoked not only by allergies but also by inflammatory conditions of the digestive tract. The conclusions derived from this study are the following: reflex gastric retention or colonic hypermotility or spasticity may be caused by alimentary allergy, and there may be another type of reflex disturbance in the large and small intestines also due to the allergic action of certain foods.

In his study the author used substances which would cause a speedy reaction in the intestines, and thus disclosed the pathological changes and their most vulnerable points. The procedure is as follows:

At midnight the patient is given 150 gr. of barium sulfate dissolved in water. Nine hours later the first roentgenogram is taken; immediately afterward 30 gr. of sodium sulfate mixed with the same solution of barium which was given the night before are administered. The second roentgenogram is taken as soon as the patient feels the first colic, and the next picture is secured just before evacuation. After evacuation still another roentgenogram is taken.

This method excludes errors and saves time. It secures a clear picture of the entire digestive apparatus. It shows the functional interdependence of stomach and colon, and it permits a close study of colonic function. According to this method, evacuation and reflex function are accomplished in the normal individual in from two to three hours. Fifty per cent of the intestinal content is evacuated. In the majority of cases of diarrhea, evacuation of the intestinal content takes place in one or one and one-half hours. In constipation, from six to ten hours, or more, are required before evacuation takes place.

When there is no agglutination of the viscera or adherence due to organic processes, the colon contracts and functions freely, and this is visible. When the viscera are impeded in any way segmentary obstruction of the colon and functional disturbances can be seen. HILDA H. WHEELER.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Bengolea, A. J., Velasco Suárez, C., and Negri, A.: A Study of the Normal and Pathological Physiology of the Bile Tract (Consideraciones sobre la fisiología normal y patológica de las vías biliares). *Bol. y trab. Acad. argent. de cirug.*, 1940, 24: 1091.

The authors emphasize the importance of a thorough knowledge of the physiology of the hepatobiliary tract in order to avoid performing operations contrary to normal physiology. They present photomicrographs showing the histological picture of the different parts of the tract and illustrating their argument.

They hold that the hepatocommon duct is a tube of elastic connective tissue which presents a complex sphincter mechanism only at the end. This sphincter mechanism consists chiefly of the sphincter of the common duct. Vater's ampulla is an organ that is undergoing retrogression in the human being and is a union of the common duct and Wirsung's duct. The ampulla in some of the lower forms of animals is described. Vater's papilla is represented in the majority of cases by the union of the two ducts and its musculature is only slightly developed.

The most important organ physiologically is the sphincter of the common duct, which by its tonicity permits filling of the gall bladder and on contracting independently prevents the bile from passing into Wirsung's duct, so that the latter duct can evacuate the pancreatic juice independently. The proximal part of the common duct has almost no muscle fibers and in some cases there are hardly any longitudinal fibers. The hepatic duct has no muscle bundles but is very rich in elastic fibers. The cystic duct does not have any muscle fibers.

The hepatocystic spur, or valve of Puelch, has the task of regulating and directing the current of bile, either into the gall bladder or from there into the duodenum, and thus prevent the reflux of the liquid into the hepatic duct. Such a reflux into the hepatic duct may take place when this valve is insufficient from temporary or permanent dilatation of the common duct. The theory that there is a sphincter of the hepatic duct should be given up entirely.

The bile tract is essentially a system of elastic tubes, and dilatation of the chief ducts, if there is no obstruction at the end, is due to a mechanism of compensation which should be respected. Under these circumstances no operation for derivation of the bile should be performed; these operations should be reserved solely for cases of cicatricial stenosis or neoplasm of the terminal end of the tract.

AUDREY G. MORGAN, M.D.

Berger, S. S., and Applebaum, H. S.: Toxic Hepatitis Due to Sulfanilamide. *J. Lab. & Clin. Med.*, 1941, 26: 785.

A case of fatal hepatitis (subacute yellow atrophy of the liver) is presented. Only 26.6 gm. of sulfanilamide were ingested, 20 gm. of which were distributed over a period of ten days.

The patient underwent a prostatectomy for benign hypertrophy and chronic and subacute prostatitis. As part of the pre-operative treatment, 10 gr. of sulfanilamide were given three times daily for three days. There were no untoward symptoms. Because of pyuria three weeks after discharge from the hospital, the patient was given six 5 gr. tablets of sulfanilamide daily for ten days (total 20 gm.). Soon after starting the drug he began to have anorexia, nausea, and weakness, and began to pass "coffee-like" urine and light-colored stools. As soon as the drug was discontinued, these symptoms subsided. Physical examination revealed a considerable degree of jaundice, an enlarged liver, and a palpable spleen. The jaundice was of the obstructive type, and it was the opinion of the authors, chiefly because of the enlarged spleen, that the patient had toxic hepatitis merging into a chronic state, because of the sulfanilamide. Ascites gradually developed and increased rapidly. The patient became drowsy (cholemia) two months after the drug was discontinued and died after a week of coma.

Necropsy was not permitted, but several small segments of liver tissue were obtained through a puncture wound. The liver was firm and finely granular. Microscopic examination showed early degenerative changes in many of the liver cells. In these areas there was abundant bile pigment in the cytoplasm of the liver cells and bile in the canaliculi. In other areas the cells were necrotic. The periportal areas were infiltrated with wandering cells, most of which were small and round. The normal lobulation of the liver was destroyed, the intact liver tissue occurring in irregular small rounded nodules, characteristic of beginning cirrhosis. The anatomical diagnosis was extensive necrosis and replacement fibrosis of the liver ("toxic hepatitis," "subacute yellow atrophy," and beginning cirrhosis, "toxic cirrhosis").

There was no reason to believe that this patient had any liver damage previous to the administration of the sulfanilamide. There was a history of hay fever of about five years' duration, but this could not be investigated.

Sulfanilamide should be added to the list of agents which may cause severe liver damage.

HAROLD LAUFMAN, M.D.

López Estévez, J.: Cholecystographic Study of the Gall Bladder According to Carrere's Method and Its Clinical and Operative Applications (El estudio colecistográfico de la vesícula por el método de Carrere y sus aplicaciones clínicas y operatorias). *Arch. argent. de enferm. d. apar. digest.*, 1940, 16: 46.

The mechanism of the biliary circulation depends on the portal circulation, the anatomical and functional integrity of the liver cells, the metabolic centers, and the central nervous system, as well as on hormonal and alimentary stimuli, the balance between the sympathetic and the parasympathetic system, and conditions of the abdominal viscera.

Among all these factors the rôle of the portal circulation is of greatest importance.

The analysis of the hepatobiliary pathology from the functional point of view can be best accomplished by a combination of cholecystography with duodenal drainage according to Carrere's method. The so-called "vesicular rhythm" can thus be visualized in roentgenograms. The first picture is taken twelve hours after an injection of a tetra-iodo product. Four-tenths of a gram of the product per kilogram of body weight is dissolved in 20 c.cm. of double distilled water and the injection is made very slowly. After the first picture has been taken, the patient is given 200 c.cm. of a 40 per cent glucose or saccharose solution per os. The second picture is taken one-half hour later, the third one hour, and the fourth two hours after ingestion of the sugar solution. Under normal circumstances the shadow of the gall bladder taken one-half hour after the administration of the sugar solution is smaller than the corresponding shadow in fasting. The following picture shows a still smaller shadow, while the size of the gall bladder in the last picture is approximately the same as in the first. Under pathological conditions, when the duodenohepatovesicular reflex is exaggerated, the shadows cast by the gall bladder grow progressively smaller. In other cases the size of the shadows may alternate: large and small, large and small. In some instances a paradoxical condition may be found: in the first picture taken in fasting the shadow is small, in the second it appears larger, in the third it is again small, and in the fourth it resembles the size found in the second picture.

The author discusses at length the clinical interpretation of the various types of vesicular rhythm.

JOSEPH K. NARAT, M.D.

Smyth, M. J.: Exploration of the Common Bile Duct for Stone. Drainage with the T-Tube and Cholangiography. *Brit. M. J.*, 1941, 1: 111.

Controversy about the subject of exploration of the common bile duct arises in cases in which there is little or no indication for exploration of the duct, or in cases in which there is doubt as to the interpretation of operative findings.

Indications for exploration of the common duct for stone are presented, including both clinical features and conditions at operation. Smyth warns against placing too much reliance on the presence or absence of jaundice as a clinical feature. At a conservative estimate jaundice has been absent in no less than one-third of the cases.

In cholangiography an opaque solution is introduced into the common bile duct and a radiograph taken. This may be done either at the time of operation or postoperatively. In the latter event the solution is introduced through the drainage tube of the common bile duct. After surgery a T-tube can be retained until liver function has been restored, and after twelve days cholangiography can be accomplished. Smyth considers the regular T-tube to be out of proportion and advises that the circumference be whittled down until it measures 1½ in. in length, and that half the circumference of the tube be removed. The tube is then easily introduced and readily removed without causing discomfort. The opening in the common bile duct is closed snugly around the tube and no stitch through the tube is necessary. A second tube provides proper drainage. Smyth is convinced that even the most competent operators can be safeguarded against error if they will adopt the principle of using a T-tube for drainage of the common duct and carry out cholangiography postoperatively.

A preference is stated for perabrodil as the opaque solution in cholangiography. Bile is first aspirated from the common bile duct through the T-tube. The opaque solution is warmed to 100° F., and is then introduced from a sterile syringe. The average amount used by the author is about 15 c. cm.

If stones are discovered by cholangiography, two alternatives may be tried before resorting to further operation. Bile may be aspirated, from 1 to 2 c. cm. of ether introduced, and the tube left open so that the ether may not cause too much pressure within the duct. This is done with the hope of dissolving the stones. The alternative is to study the effects of different drugs on the sphincter of Oddi by means of opaque media.

The T-tube should be removed when the concentration of bile salts returns to normal. Ordinarily this occurs at about the fifteenth day. Smyth cautions against too prolonged and continuous drainage.

EARL GARSIDE, M.D.

Ireneus, C., Jr.: Experimental Bile Pancreatitis, with Special Reference to Recovery and to the Toxicity of the Hemorrhagic Exudate. *Arch. Surg.*, 1941, 42: 126.

The rôles of cholelithiasis, activated trypsinogen, and bile salts are mentioned as factors in the production of pancreatitis, as suggested by various authors. Opinions of many workers are given regarding the power of the pancreas to regenerate, the consensus being that it apparently does so to a remarkable degree. The contention of most workers is that fat necrosis is secondary to acute pancreatitis.

Experimental pancreatitis was produced by the writer by the introduction of sterile gall-bladder bile into the accessory duct of the dog's pancreas. The severity of the pancreatitis produced was proportionate to the amount and concentration of the bile used. Biopsy specimens of the pancreas were taken within two or three minutes, and of the pancreas and liver from twenty-four to twenty-eight hours later. Observations were made at weekly intervals up to eight weeks.

A detailed report of the gross and microscopic findings is given, the latter being illustrated with excellent photomicrographs.

In 25 of the 40 animals studied, hemorrhagic or necrotic pancreatitis, accompanied by fat necrosis, was observed. The 15 other animals showed acute

edematous pancreatitis, and fat necrosis was observed in only 8 of these. This indicated that fat necrosis is more apt to be found in the more severe types of the disease.

Most of the dogs recovered within about four weeks, with residual edema and fibrosis and lymphocytic infiltration which was noted histologically. Areas of complete necrosis were replaced by scar tissue, but acinar cells that were merely damaged and not destroyed recovered, regenerated, and became functionally efficient. It is emphasized that biopsy specimens of the gland taken a short time after the presence of acute pancreatitis may appear practically normal, and erroneous diagnoses may thus be made.

Because some surgeons believe that the fluid found in the peritoneal cavities of patients with pancreatitis is toxic, and justify a laparotomy on the basis of drainage of this material, the author injected this hemorrhagic exudate intraperitoneally into mice and intravenously into dogs, and found it to be non-toxic.

The livers of these animals showed typical microscopic changes of toxemia: namely, edema, cloudy swelling, hemorrhage, necrosis, and fatty degeneration. Hepatic insufficiency must thus be considered as contributory to the toxemia of patients with acute pancreatitis.

Insufficient time intervened between pancreatic injury and biopsy of the liver to show any relation between pancreatic deficiency and fatty infiltration of the liver, as has been shown by others. It was assumed, since both conditions were produced in the same way, that acute edematous pancreatitis and acute hemorrhagic pancreatitis are stages of the same process. S. Lloyd Teitelman, M.D.

Jacquet, P., Thieffry, S., and De Chirac, G.: The Action of Ephedrine and Adrenaline in Acute Pancreatitis (L'action de l'éphédrine et de l'adrénaline sur les pancréatites aigues). *Presse méd.*, Par., 1940, 48: 1041.

Jacquet and his associates have previously reported 3 cases of acute pancreatitis in which the typical severe epigastric pain with radiation especially to the back occurred in a sudden attack without any prodromal symptoms. The patients were very pale and showed symptoms of shock, although the blood pressure did not show any marked drop. In these cases ephedrine was employed with good results. In the first case treated, the drug was used primarily to combat the symptoms of shock; the pain was relieved when ephedrine was given in a dosage of 4 cgm. daily; operation was necessary later in this case, because of pancreatic necrosis. In the second case, the initial dose of ephedrine was 8 cgm. daily; later this was reduced to 4 cgm.; the symptoms were entirely relieved without operation. In the third case ephedrine was given in a single dose of 4 cgm. on several occasions, which markedly relieved the pain and shock, but operation was finally necessary in this case. Dreyfus also reported a case in which ephedrine was given after operation for acute pancreatitis, when the patient appeared to be dying; ephedrine, in a dosage of 6 cgm. daily for four days, brought about complete recovery. Other authors have used adrenaline.

Ephedrine and adrenaline are usually employed as adjuvants to surgery in acute pancreatitis, but in one of the authors' cases, as noted, ephedrine was effective in relieving the symptoms and evidently causing regression of the pancreatitis without surgery. A dose of 8 cgm. daily was necessary in this case. In order for ephedrine or adrenaline to be effective in acute pancreatitis, large doses must be used, much larger than those usually employed in therapeutics; (the authors have never observed any signs of intolerance to the drug in these cases). Both drugs must be given by injection, and the treatment must be continued for several days in order to obtain the best results. Couvelaire has shown that the initial lesion of acute pancreatitis is edema of the pancreas and of the surrounding peritoneum. Ephedrine or adrenaline reduce this edema; this action of adrenaline has been observed in 1 case at operation, as noted by Chapuis in his thesis in 1937, in which he quotes an unpublished report by Henry.

Alice M. Meyers.

Kauer, J. T., and Glenn, F.: Carcinoma of the Pancreas. *Arch. Surg.*, 1941, 42: 141.

A statistical study of 32 proved cases of carcinoma of the pancreas admitted to the New York Hospital over a seven-year period is presented. The incidence of this lesion was 1 in every 752 admissions. The disease occurred in men more than twice as frequently as in women.

The symptoms most commonly found were pain, jaundice, and loss of weight. It is of interest to note that pain was the most common complaint, and the authors point out the error of the phrase "painless jaundice" so often found in textbook descriptions of the clinical findings. The pain is usually described as dull and boring, often going through to the back.

The most common finding on physical examination was jaundice. The liver was enlarged in about half of the cases and the gall bladder was palpable in one-third.

Gastric hypo-acidity and anacidity were frequently present. Roentgenological examination proved of little diagnostic value. Examination of the stools for fat offered one of the most useful indexes for determining the absence of pancreatic juice in the intestinal tract.

Twenty-three of the 32 patients were subjected to operation, the majority of the operations being of an exploratory or palliative type only. Cholecystogastrostomy was performed in 9 cases, cholecystoduodenostomy in 1 case, and cholecystectomy plus choledochotomy in 1 case. The conclusion was drawn that palliative operations did not prolong life in the group as a whole.

Cancer was found to be located in the head of the pancreas in 23 cases, in the head and body in 4, in

the body and tail in 4, and in the entire gland in 2 cases. The total average duration of the disease was about nine months from the onset of symptoms.

A one-stage radical type of pancreaticogastrostomy is suggested in favorable cases, but as yet it has not been performed on human beings.

LUTHER H. WOLFF, M.D.

MISCELLANEOUS

Dorling, G. C., and Eckhoff, N. L.: Chemotherapy of Abdominal Actinomycosis. *Lancet*, 1940, 239: 707.

The usual course of actinomycosis infection of the abdomen is a discouraging downhill one, with the development of multiple fistulas, usually terminating fatally. In 1937 the first reports of cases of this disease which responded to chemotherapy with sulfonamide drugs appeared. Since then, a number of other cases have also appeared. To these are added the authors' 5 cases, 4 of which showed complete recovery.

Abdominal actinomycosis usually follows an operation for a gangrenous or ruptured appendix. At least this was the initiating factor in all these cases. The diagnoses were confirmed in all instances by culture which showed the presence of actinomycosis bovis. In the earlier cases the use of the sulfonamide drugs was started relatively late, but as the authors gained experience, they tended to use them earlier. Both sulfanilamide and sulfathiazole have been used in amounts of from 3 to 4 gm. daily. The total amounts used varied from 33 gm. in an eight-year-old child, up to 62 gm., with this treatment. There was marked amelioration in the symptoms, and in 2 cases in which operations were subsequently carried out, all evidence of the actinomycosis infection had disappeared.

The authors conclude with the following statement: "Chemotherapy should be tried early in all cases of suspected abdominal actinomycosis. Two or three courses of sulfapyridine, each lasting a week and with a week between, are usually needed."

JOHN W. EPTON, M.D.

GYNECOLOGY

ADNEXAL AND PERIUTERINE CONDITIONS

Lajos, L.: Concerning Giant Ovarian Cysts (Ueber die Riesenovarialcysten). *Geburtsh. u. Frauenheilk.*, 1940, 2: 475.

After allusion to the criteria by which Kehrer collected 100 giant ovarian cysts from the world literature covering the interval from 1873 to 1928, the author describes a personally observed case of such a tumor in a sixty-year-old nullipara. This tumor, as usual, exhibited a slow growth and first produced pain in the last two months after undergoing a considerable increase in size. It had a girth of 138 cm. and a weight of 94 kgm. After the diagnosis of pseudomucinous cyst of the ovary, a laparotomy was performed under chlor-ethyl-ether anesthesia and after puncture and the slow removal of 42 liters of fluid, the tumor which had developed partly within the ligament was removed. A supravaginal amputation of the myomatous uterus was also performed. Doses of digicharin were given to increase the strength of the heart. Weight of the tumor with the fluid was 46 kgm.; therefore, it was almost half the weight before operation.

The considerable emaciation in consequence of the loss of protein and other nutriments in the cystic fluid made necessary a differential diagnosis between Simmonds' dystrophy due to a deficit in the activity of the pituitary gland since both clinical entities can occur together. Both of these conditions can produce thinning and loss of elasticity of the abdominal wall, edema, and venous dilatation. Compression phenomena of the thoracic organs due to elevation of the diaphragm and compression phenomena of the bowels are the results of such giant tumors that make necessary prompt treatment. (Puncture, cautious removal of fluid with observation of the heart and circulation, as well as extirpation of the tumor).

Merely repeated punctures do not achieve the purpose but spoil the chances of a later radical operation because of subsequent scarring. The author does not remove the cyst as a whole, because of the large incision necessitated thereby and the great danger of shock and peritonitis which would result therefrom. One difficulty of the operation which is important is the not infrequent intraligamentous development of the tumor and the abundant adhesions which eventually make removal of the emptied cyst impossible. In such a case, the wall of the tumor must be sewed to the abdominal wall and its cavity obliterated by the use of a Mikulicz drain. Since death is due primarily to heart failure and secondarily to peritonitis, sepsis, or ileus, the importance of one or two days of preoperative treatment of the patient with cardiaca should be stressed if the condition permits. After operation this medication should be continued for a long time. Furthermore, it is necessary to accomplish the laparotomy with the smallest possible incision, with careful asepsis, and complete peritonealization of the wound surfaces.

At the conclusion of the work the author shows by a table that in operations for ovarian cysts weighing between 50 and 100 kgm. the mortality amounts to 25 per cent, while for cysts under this weight the mortality is only 6.52 per cent. Death as a consequence of heart failure occurs without exception only when the ovarian cysts weigh more than 50 kgm.

(Harlheinz Sommer). John R. Paine, M.D.

EXTERNAL GENITALIA

Farsht, I. J.: Suprapubic Transvesical Repair of Vesicovaginal Fistulas. *J. Urol.*, 1940, 44: 279.

A method of repair of vesicovaginal fistulas by the suprapubic transvesical route is described, and

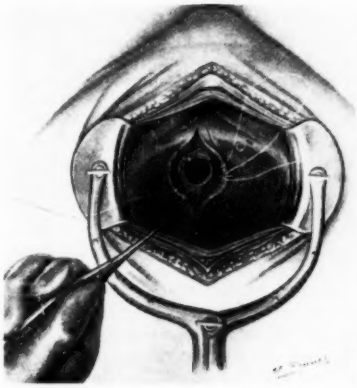


Fig. 1

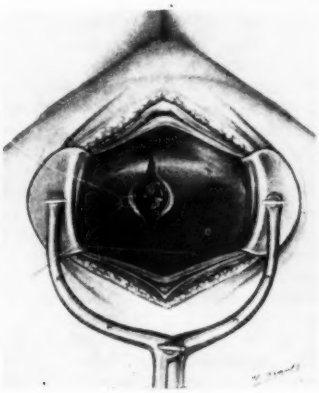


Fig. 2

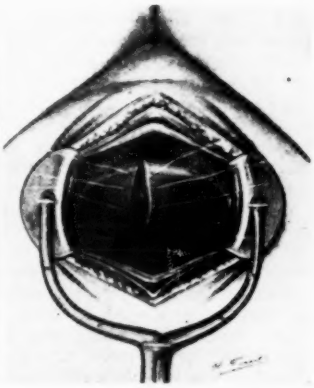


Fig. 3

an analysis of 20 cases is reported by the author. He concludes that vesicovaginal fistulas of surgical origin are on the increase while those of obstetrical origin are on the decrease.

The fistulas of surgical origin are, as a rule, fixed high up in the vagina and are in close proximity to the ureters. The inaccessibility of these fistulas from the vaginal approach makes their exposure, proper dissection, and repair very difficult.

Good exposure, careful dissection of the fistulous tract, adequate mobilization of the vesical wall, separate suture of the vesical and vaginal orifices, and proper pre-operative and postoperative care are essential for the successful repair of vesicovaginal fistulas.

The suprapubic transvesical method of approach allows the proper execution of these principles, prevents unsuspected injury to the ureters, and permits suprapubic drainage of the bladder, which the author believes is superior to other types of vesical drainage. This approach is also applicable to the majority of lower-lying fistulas which result from obstetrical injury. D. E. MURRAY, M.D.

MISCELLANEOUS

Seitz, L.: The Governing of the Reproductive Processes by the Sex Hormones in the Female—Hormonal Sexual System (Die Steuerung der Fortpflanzungsvorgaenge durch die Geschlechtshormone bei der Frau (hormonales Geschlechtssystem). *Deutsche med. Wchnschr.*, 1940, 2: 762.

It is always stimulating and enjoyable to read the work of Seitz concerning hormonal studies. The present review represents a small section of the thoughts which the author has developed much more completely in his monograph on the subject.

Seitz discusses the basic problem of the reproductive processes with great zeal and draws conclusions concerning the generally applicable rules for reproduction, both from the phylogenetic and ontogenetic viewpoints, which are extremely stimulating and interesting. Aside from this, there is nothing basically new for those who have been engaged with the question of sexual hormones.

The factors which influence the reproductive processes are divided by Seitz into general cell-nutritional substances and general cell-stimulating substances, just as the substances through which evolution and function of the gonadal glands are specifically influenced. The author then presents a detailed discussion concerning these two factors which extends into the general realm of hormonology as well as into the realm of vitamins. The presentation of the tasks and functions of the sex specific hormones, including those which are formed by the placenta during pregnancy (chorionic hormones) takes up the greatest part of the discussion.

The conclusions drawn are, for the most part, teleological in character, because the experimental bases for the conclusions still frequently present wide defects.

The author labels the entire combined system of the sexual and reproductive process "Hormonal Sexual System," which from a cellular humoral aspect is composed of three parts: (1) the cells which form the sex hormones and the gonadotropic elements, (2) the sex-specific elements themselves, and (3) the resulting cells which respond to the influences of these hormones in a specifically elective manner. The author parallels his system to the reticuloendothelial system of Aschoff, which latter has as its purpose the protection of the individual from damaging influences; in other words, its purpose is to sustain the individual; upon the hormonal sexual system rests the responsibility of sustaining the species. In the event that this system fails in any of its particular parts, the prospects of therapy are, for the most part, not very favorable. This is true especially if the disturbances have their origin in the hypophysis because we as yet know very little about the chemical construction of this hormone, and because its action is exerted over the midbrain, the functions of which are also not very well known. In treating this type of disturbance, one must possess the ability to comprehend the entire problem in order not to be left depending upon some isolated symptoms.

(F. SIEGERT). HARRY A. SALZMANN, M.D.

Loenwecken, W., Jr.: Treatment with Sulfanilamide Preparations at the Women's Clinic in Bergen (Behandlung mit Sulfanilamidpraeparaten in der Frauenklinik in Bergen). *Nord. Med.*, 1940, p. 963.

During the year 1938, 136 patients were treated at the Women's Clinic in Bergen with the sulfanilamide preparations—prontosil, M and B 693, and streptan (a Norwegian preparation). A good result was achieved in 35 per cent among a series of 43 cases of puerperal infection and a probably good result in another 33 per cent; only 2 patients were not cured on discharge from the hospital. The control material consisted of 48 similar cases which were seen in 1937. Twenty of these patients were cured on discharge from the hospital, 25 were incompletely cured, and 3 died. Nine cases of thrombophlebitis were not affected by the treatment. In prophylactic treatment, which is recommended in complicated cases with intra-uterine intervention, hemorrhage, or premature escape of the amniotic fluid, too small a dosage must not be given as it may prove ineffective and may possibly result in resistance to sulfanilamide. In 11 of 13 cases of infected abortion, a good result was observed; the best results were obtained with large doses. In 10 cases of gynecological operation with infection, all of which were cured, and in 14 cases of mastitis the effect of the drug was not certain. Of 37 cases of pyuria, 32 were cured with a simple series of treatments, 3 after repeated treatments. Among 52 cases treated with salol and hexamethylentetramin, only 12 were cured.

On comparing the preparations, M and B 693 seemed to give the best results. The dosage is 4 tablets of 0.5 gm. for the first dose, and then 2 tablets

every fourth hour during the entire day for the first three days. The next three days, two-thirds or one-half of this dose is given every fourth hour, except at night. The associated effects were as follows: nausea occurred in almost all of the 41 cases; in 10 there was vomiting and in 1 an exanthem. Among the 70 patients treated with streptan 1 had nausea, 1 vomiting, and 2 urticaria. Prontosil, which was used in 25 cases, produced vomiting in 2, icterus in 2, and exanthem in 1.

(Axel Olsen) Louis Neuwelt, M.D.

Bracht: Thrombosis and Embolism in Gynecology (Thrombose und Embolie in der Frauenheilkunde). *Deutsche med. Wchnschr.*, 1940, 2: 1014.

According to almost all statistics, the highest figures for thrombosis and embolism are found in gynecological operations. In the order of importance the operations are for carcinoma of the uterus and ovaries, and for myomas, exploratory laparotomies, and vaginal operations. Obstetrics also includes puerperal thromboses and embolism. Abdominal section gives the greatest incidence and this is followed by manual freeing of the placenta and palpation of the placenta.

Statistics covering 3,000 births showed that among 691 operative cases (including episiotomy and perineal suture) there were 39 cases of thrombosis and 4 or 5 cases of embolism during the puerperium. There was no fatality. The author is of the opinion that the thromboses encountered in obstetrics are, for the most part, of infectious origin. This view is supported by the fact that in 1,033 infected births, there were 58 cases of thrombosis during the puerperium, but no embolism. According to general, accepted evaluations, the percentage of fatal embolism which occurs during the puerperium amounts to 1 per cent.

Among 800 operative gynecological cases (mostly tumor material, not including minor operations) there were 18 thromboses with multiple severe infarcts and 1 fatal embolus, the latter in a fifty-six-year-old woman with carcinoma of the ovary. In contradistinction to the obstetrical cases it was found that in operation performed for other infectious conditions (one-fourth of the entire operative material), only one-ninth as many thromboses occurred.

Among 100 cases of infected cervical carcinoma which were operated according to the vaginal method of Schauta, no thrombosis or embolism occurred. The author attributes this favorable result, for the most part, to the method of anesthesia (caudal anesthesia at the level of the third lumbar vertebra and parasacral anesthesia). The type of anesthesia and the technique of operating are very important factors in the question of thrombosis, although occasionally this fact is underestimated. In the cases of mild thrombosis in the saphenous region the application of a plaster bandage and getting the patient out of bed gave the best therapeutic results. Thrombosis of the femoral vein and thrombophlebitis should be treated by strict bed rest. Sympatol proved of no value prophylactically (Koenig); neither did the raising of the foot of the bed (Schmidt and Reichenberg).

The removal of the thrombus according to the method of Kulenkampf is critically discussed. For the further elucidation of the problem of thrombosis and embolism, it is important to improve the diagnosis of the distant thrombi resulting from stasis and to improve the methods of determining the point of origin of the embolus, and, finally, it is necessary to study thoroughly and explain all cases of fatal embolus with reference to their source and character.

(Saal). Harry A. Salzmann, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Tscherne, E., and Engelhart, E.: New Aspects Concerning the Question of Protracted Pregnancy (Neue Gesichtspunkte in der Frage der uebertragenen Schwangerschaft). *Muenchen. med. Wchnschr.*, 1940, 2: 996.

After the authors refer to the significance of the menstrual status for the calculation of the normal termination of pregnancy, they emphasize the danger to the life of the child in actual protraction of pregnancy beyond term. In 1,222 cases in which the calculated term had been exceeded by at least ten days the fetal mortality amounted to 7 per cent. This danger particularly involves male fetuses, for which there exists a marked tendency to carrying beyond term (among 1,222 children carried beyond term, there were 800 boys and 422 girls). The male fetus is also more often endangered by complications during delivery; thus in this series, 6 cases of fetal death occurred in protracted pregnancies, 5 of the fetuses being male. In older primiparas, the involvement of the male fetus carried beyond term is especially marked, the fetal mortality in this group being 19 per cent.

The roentgenological determination of the size of certain bone centers is recommended as an aid in the diagnosis of protracted pregnancy beyond term. Special significance in this respect is attributed to the proximal center of the tibia, which was found to have a minimal diameter of 7 mm. only in children who had been carried beyond term; furthermore, the size of this center can be determined roentgenologically while the fetus is still in the uterus.

On the basis of the authors' experience, attention is called to the value of this observation for clinical obstetrics. The currently existing opinion, that the cause of prolongation of pregnancy is supposed to be based upon an abnormal relationship between the follicular hormone formed in the placenta and the corpus luteum hormone, was borne out by the fact that the determination of the placental hormone in the case described yielded subnormal values (from 800 to 1,000 mouse units).

(TSCHERNE). HARRY A. SALZMANN, M.D.

Dippel, A. L., and Brown, W. H.: Roentgen Visualization of the Placenta by Soft-Tissue Technique. *Am. J. Obst. & Gynec.*, 1940, 40: 986.

The placenta was clearly visualized by soft-tissue roentgenography in 236 (90 per cent) of 262 observations on 259 patients, in 261 pregnancies. The greatest factor interfering with visualization was found to be hydramnios, which accounted for non-visualization in 5.73 per cent of the roentgenograms. Unsatisfactory x-ray films were obtained in 3.05 per cent of the cases, and it was impossible to visualize the placenta in 2 of 8 cases of twin pregnancy. Immaturity, provided the pregnancy has advanced beyond the midpoint, and abnormal presentations and positions are not hindering factors in visualization.

Calcification of the placenta is rarely extensive enough to aid in localization of the placental site. No other adjuncts to actual visualization were found. Fetal position is not a reliable criterion of the location of the placenta. No errors in roentgenological localization of the placenta were found in the 53 instances which were checked by reliable clinical methods. The placental implantations were almost equally divided between the anterior and posterior walls of the fundus. However, with low implantation, essentially eight times as many placentas were found implanted on the anterior as on the posterior wall of the lower uterine segment. The average thickness of the walls of the fundus uteri near term measured 1.24 cm. on the roentgenograms which were made at a distance of 42 in. Only 11 (12 per cent) of 92 patients with vaginal bleeding were found roentgenographically and clinically to have true placenta previa; 15 others presented merely x-ray evidence of low implantation of the placenta, without the usual clinical signs.

Soft-tissue roentgenography in obstetrics finds its greatest usefulness in those cases of vaginal bleeding in which the whole of the placenta can be visualized above the level of the iliac crests, and these constitute the great majority (88 per cent) of the instances of vaginal bleeding in the latter months of pregnancy.

EDWARD L. CORNELL, M.D.

Stanek, I.: Benign Tumors of the Placenta (Gutartige Tumoren der Placenta). *Bratislav. lek. Listy*, 1940, 20: 182.

The first description of a placental tumor comes from Clarke (1788). According to Leopold they occur once in 8,000 births. According to Clarke and Frankl they derive from elements of the chorionic vessels. In 1903 Dienst collected all the cases described in the literature, subjected them to criticism, and suggested the term chorioma angiomatosum or fibromatosum. The author describes the macroscopic appearance, microscopic structure, and origin of these particular tumors as they are recorded in the literature. Some authors stated that they could find no angioneoplasms, while others disagreed with this statement.

The author's case is that of a primipara who never suffered any circulatory disturbance. She had a spontaneous delivery, no hydramnion, and no postpartum hemorrhage. The placental tumor occurred 4 cm. from the umbilical insertion and consisted of two lobes. One lobe was on a 4 cm. pedicle formed of three vessels and scanty embryonal tissue. One of these vessels was thrombosed. The largest vessel led into the umbilical vein, 2 cm. above the insertion of the cord. Both lobes consisted of and were connected

by homogeneous tissue. The pedicled lobe lay free on the placental surface, and impression traces were not visible on the placenta. Cross sections of the tumor were dark red-brown with grossly visible vessel lumens. In some places there were shaggy tufts of chorionic villi. Microscopically it showed large and small nodules of tumor tissue which were surrounded by heavy fibrous tissue. In the nodules were capillary spaces lying closely together; the diameter of these spaces was occasionally only that of an erythrocyte and usually wider. The capillaries were lined with hypertrophied endothelial cells with large nuclei which projected into the lumens. The latter were round, oval, or gaping, and often anastomosed with one another. In places there were numerous erythrocytes and a few leucocytes in the lumens, and in other places the capillary spaces were practically empty. The capillary formations were found in a net of fine and coarse edematous connective-tissue fibers where larger nutritive vessels entered. In other areas the capillary spaces were closely pressed together. In the other lobe of the tumor there were areas in the vicinity of the thrombosed vessel in which necrotic tissue with calcium deposits were visible. Here and there the tissue had a myxomatous or myxofibromatous appearance. The chorionic villi showed angiomatous changes, were covered with fibrin, and at no place penetrated into the tumor tissue.

There is no unanimity of opinion as to whether chorio-angiomas are true tumors. Many old and new thoughts (Niebergall, Kraus, Ribbert, Hinselmann, Boeki) as to the etiology are advanced. Clinically the chorio-angiomas are benign.

The author was able to gather 8 cases of primary malignant tumors of the placenta from the literature, and 3 cases of metastases in other organs. Chorio-angiomas are often associated with hydramnion. Bleeding in the post-partum period from chorio-angiomas has often been reported.

(Janisch-Raškovič). E. S. Burge, M.D.

Dieckmann, W. J., and Kramer, S.: Edema in Pre-Eclampsia and Eclampsia. *Am. J. Obst. & Gynec.*, 1941, 41: 1.

The following physiological changes occur in normal pregnancy:

The venous pressure in the legs is increased and causes an increased loss of fluid from the blood, which fluid enters the tissues of the legs. There is an increased capillary permeability. The elimination of water and solids by the kidney is delayed or impaired. The average serum-protein concentration is 6.5 gm. per cent. The average colloid osmotic pressure of the serum protein is 28.7 cm. of water.

Preëclampsia and eclampsia may occur if these changes are of greater magnitude than normal, or if they are exaggerated by internal or external factors. Thus, the following changes are found in these diseases:

Greater alterations than normal occur in venous and capillary pressures and capillary permeability. The average serum-protein concentration in edematous patients with preëclampsia is 6.22, with eclampsia it is 6.7, and with vasculorenal disease and normal renal function it is 6.67 gm. per cent. The average colloid osmotic pressure of edematous preëclamptic patients is 24.9, and of toxemic patients without edema 26.5 cm. of water. The retention of sodium, chlorine, and water is greatly increased in some pregnant patients, which results in an abnormal gain in weight and, finally, in demonstrable edema. Changes in the concentration of the female hormones are apparently associated with edema, but whether this is the cause or the result cannot be stated from our present knowledge. The prevention and treatment of edema are dependent on the limitation in the diet of the principal components of edema fluid, namely, sodium chloride and water. The curtailment of sodium chloride in the diet presents fewer difficulties and causes less discomfort to the patient than the restriction of water.

Edward L. Cornell, M.D.

LABOR AND ITS COMPLICATIONS

Daron, D.: Administration of Carbon Dioxide for the Induction and Acceleration of Labor (Die Anwendung der Kohlensaeure als neue, die Geburtstaetigkeit erregende und beschleunigende Provokationsmethode). *Akuš. i. Ginek.*, 1940, 6: 31.

Of all the methods devised for the induction and stimulation of labor, Brown-Séquard's theory of uterine asphyxiation deserves special consideration. According to the procedure of Thaler, who for some years has made use of carbon-dioxide inhalations for stimulation of labor, a mixture of 80 per cent air, 5 per cent carbon dioxide, and 15 per cent oxygen was used. The inhalation was continued for four or five minutes and if necessary was repeated with a double quantity of carbon dioxide after from twenty-five to thirty minutes. Improved uterine activity was obtained in nearly all the cases by the use of this method. In 1 case of delayed expulsion of the placenta due to uterine atony, the placenta was expelled twelve minutes after the inhalation of carbon dioxide. (von Schroeder). Edith Schanche Moore.

Kaufmann, D.: The Significance of Manual Dilatation in the Treatment of Functionl Soft Part Impediments to Delivery (Die Bedeutung manueller Dilatationsmethoden fuer die Behandlung funktioneller Weichteilschwierigkeiten unter der Geburt). *Zurich*: Dissertation, 1939.

First, a classification of the functional difficulties caused by the soft parts in dilatation is given, and then the author considers the consequences of these difficulties attendant upon the mother and child. A short summary of the usual methods of dilatation is given. The author's conclusions drawn from approximately 5,000 cases seen in five years were that 7.3 per cent of these presented functional perineal difficulties which demanded treatment by manual dilatation, two-thirds being cervical, and

one-third in the lower birth canal. Primiparas made up the great majority of those presenting this emergency; in the first stage of labor there were 15 per cent of multiparas, and in the second stage 10 per cent of multiparas. The average age of the patients requiring dilatation was thirty years, therefore relatively high. In 26.7 per cent of the dilatations of the upper birth canal and in 24 per cent of the pelvic-floor and vaginal-vault dilatations, there was a slight degree of contracted pelvis, which emphasized the importance of the constitutional type in soft-part difficulties. In 34.6 per cent of the cases premature rupture of the membranes was present; this occurred in only 20.4 per cent of the total group of deliveries. Ten per cent of the babies weighed over 4,000 gm.; 40 per cent over 3,500 gm., and only 15 per cent under 3,000 gm. Abnormal positions were not any more frequent than in spontaneous deliveries.

For the use of manual dilatation exact indications are given: in the first stage of labor it should be used if there has been no progress for several hours under otherwise normal conditions with active labor contractions and the cervix is at least the size of a 5 mark piece (silver dollar); in the second stage it should be used after two hours have elapsed under otherwise normal conditions. The author believes that this indication behooves one to be cautious and circumspect and not to interfere prematurely with the physiological course of labor.

Cases in which the well-being of the mother and child are at stake in which intervention must be made earlier, and the dilatation of the pelvic floor must follow swiftly after the stretching of the upper birth canal to insure the prompt termination of labor are also considered. The prerequisites for manual dilatation are: no disparity between head and pelvis; entry of the presenting part into the pelvis; and the size of the cervical os must be that of a 5 mark piece. All other possible remedies should have been tried, such as ecbolics and spasmolytics. The dilatation itself is to be regarded as an operation and requires, therefore, the strictest aseptic preparation.

After these precautions have been taken, the dilatation is performed with the patient across the bed in the lithotomy position; a persisting bag of waters is ruptured. With one or two fingers the cervix is spread radially in all directions only during a pain. The procedure may be done in general without any anesthesia. In a similar manner, the pelvic floor is stretched.

The results from this method are good, the mortality for the mother nil, and for the child 0.8 per cent (4 deaths, of which only 2 could be ascribed to the procedure). The maternal and fetal morbidity are not higher than in normal deliveries. In 4.2 per cent of the cases, the dilatation procedure was not sufficient to bring about the desired early termination of labor. The efficiency of the dilatation procedure lies in the abbreviation of labor, whereby the potential danger for mother and child in a protracted birth is avoided. Furthermore, many more extensive vaginal operations are in this way rendered unnecessary. There is but slight danger of infection and injury of the soft parts if the matter of aseptic technique is strictly observed.

(Kimmig). E. S. Burge, M.D.

THE CLINICAL MANAGEMENT OF RENAL TRAUMA

Collective Review

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A SURVEY of the recent literature shows several newer developments in the clinical management of renal trauma. We wish to draw especial attention to the following features. Excretory urography, as well as retrograde pyelography, are important factors in the diagnosis and follow-up of cases of renal trauma. There is a growing trend to conservatism in the management of the case, and a tendency toward greater conservatism in the type of surgical procedure used. The prognosis has been improved with the newer urinary antiseptics. There is also better understanding of, and improved treatment for the aftermath of the trauma.

Because of their mobility and position, being protected by the lower ribs and spinal muscles, the kidneys are but rarely injured, yet it is worthy of note that about 8 per cent of the surgery of the kidney is due directly to trauma. When we consider the delayed results of trauma as well, this percentage becomes considerably greater.

On account of greater vocational exposure to trauma as well as the lesser anatomical protection afforded, injuries to the kidneys are more common in the male than in the female, roughly in the ratio of 6 to 1. Because of the greater infantile renal ptosis, sparsity of perirenal fat, and the greater tenseness of the peritoneum, trauma is, relatively speaking, more common in children than in adults. By reason of its lower position, the right kidney is more often affected than the left. Bilateral rupture is extremely rare.

While the importance of preëxisting pathological lesions has been minimized by some, others believe that such conditions may be predisposing causes. It is reasonable to presume that hydronephrosis or pyonephrosis, congenital anomalies, abscess, tuberculosis, carcinoma, and chronic pyelonephritis might be contributory in that a lesser trauma would be necessary to cause a rupture. Ectopia, and stricture or kinking of the ureter, or any type of obstruction causing hydraulic back pressure and interfering with normal drainage might also fit into this group.

Injuries to the kidneys are commonly classified as closed or open. The former may be due to direct or indirect trauma. Campbell analyzes the mechanics of rupture of the kidney as follows:

The blood in the encapsulated organ subjected to a sudden blow, in accordance with the law of hydrostatics, transmits that blow equally in all directions throughout the mass, and varying degrees of trauma may produce results varying from minor lacerations to complete explosion of the viscus. Blows to the loin or abdomen may push the kidney against the last rib which acts as a fulcrum over which the organ may be contused or lacerated. With a lumbar blow, the lower ribs may be pushed directly against the kidney, or this organ may be impounded against the liver. Lateral blows may cause a crushing of the kidney against the spine or transverse processes. Further, the kidney may be injured by penetration by fractured vertebræ, ribs, or pelvic bones.

The application of indirect force may also result in acute rupture of the kidney. In addition, this organ may be dislocated as the result of the pull on its attachments, or it may even be broken off at the pedicle. Further, and particularly when the body is in a flexed position, upon sudden muscular exertion a contraction of the diaphragm or of the abdominal or lumbar muscles may thrust the kidney against the spine, the ribs, or the liver with an ensuing rupture. Cases of this type are infrequent. Rupture of the contralateral kidney by the mechanics explained is quite rare.

The other group of renal injuries is of the open or penetrating type. These may be caused by knife, sword, bullet, or other projectiles, and the extent of the injury may vary from minor punctures to extensive ruptures or lacerations.

In addition, a further group involves the trauma due to instrumental or surgical procedures. Through use of the cystoscope, injury may occur in the form of penetration by either catheter or bougie or it may result from a metal instrument such as might be used to dislocate a stone or to dilate a stricture. Serious injuries have been reported from excessive pressure of the injected media in the taking of retrograde pyelograms. Among the operative injuries have been listed: tearing of the vena cava, trauma to aberrant vessels, rupture of the kidney pedicle, tearing of the renal parenchyma, intentional trauma as for nephrostomy, explosion caused by a blood-clot impaction at the ureteropelvic junction, especially after nephro-

lithotomy, and, also, injuries to the diaphragm, pleura, and peritoneum.

Numerous classifications of the different types of ruptured kidney have been propounded. We will follow that of Gutierrez. He designates the following main types of lesion:

1. Rupture of the true capsule, with or without accompanying rupture of the parenchyma.

2. Rupture of the kidney parenchyma, with or without rupture of the capsule. The lesions without rupture of the capsule may or may not communicate with the pelvis or calyces. Those with rupture of the capsule show a variety of types: stellate rupture, fragmentation, perinephritic hematoma without hematuria, and those lesions in which hematuria occurs as the result of communication with the excretory apparatus.

3. Rupture of the excretory apparatus of the kidney may include the rupture of a calyx with rupture of the renal parenchyma and the formation of a pseudohydronephrosis; or there may be simple rupture of a calyx and its papillæ causing hematuria. With or without rupture of the kidney parenchyma, there may occur a rupture of the pelvis, accompanied by infiltration of urine, hematoma, or perinephritic abscess. There may be a rupture of the ureter at any level with or without rupture of the renal parenchyma, but in any event with an infiltration of urine.

4. Rupture of the blood supply of the kidney. This may be in association with an aneurysm of the renal artery, a rupture of the vena cava or renal veins, or a partial or complete tear of the renal pedicle.

5. Rupture of the surrounding tissues and neighboring organs may result in the formation of a perirenal hematoma, and if infection occurs, a perinephritic abscess or a fistulous tract to neighboring organs may develop. Such might originate from rupture of the fatty capsule or from trauma to muscle or to the adrenal gland.

6. Rupture of the kidney into the subphrenic or thoracic organs. Rupture of the kidney may occur intrathoracically from a subphrenic or pleurobronchial lumbar fistula, or intraperitoneally from a fistula into the stomach, duodenum, or colon. It should be pointed out that the diseased kidney, as in tuberculosis, tumors, nephrolithiasis, or pyonephrosis, is more apt to rupture than the normal.

If the capsule is ruptured, escape of blood into the perirenal tissues with the formation of a hematoma is the rule, the size of the latter depending on the site of rupture and the severity of bleeding. Rupture of a renal blood vessel may also cause a hematoma. As the latter grows in size, the bleeding may be partially or completely arrested by increased pressure on the kidney and surrounding tissues. If the parenchyma only is injured, there is no escape of urine into the surrounding tissues; but if a calyx, the pelvis, or the ureter is ruptured, urinary extravasation results. (Wesson states that urine in the cellular tissue always indicates a torn pelvis or a ruptured calyx, since lacerated renal substance is not capable of secreting urine.) If this urine is small in amount and uninfected, it may be absorbed, but if it is of large amount or if infected with pathogenic organisms, perinephritis or a perinephritic abscess usually occurs. Abeshouse has collected 64 cases in which the rupture was of the pelvis only without damage to the renal parenchyma. He notes that previous renal disease tends to the occurrence of such an injury.

Among the various factors complicating the picture of ruptured kidney are infection in the kidney itself or in the surrounding tissues, and hydronephrosis due to injury or obstruction of the ureter with resultant stasis in the renal pelvis. And, in addition, there may be fractures of the bony structures, rupture of the peritoneum, and injuries of other visceral organs, especially the spleen and liver. Such may be of even greater import than the injury to the kidney itself.

Open wounds may give a quite similar picture, but are often complicated by the introduction of foreign material. A bullet wound is apt to be penetrating, while that caused by a larger projectile is frequently of the stellate type. Wounds from such sources are usually associated with injuries to other organs or to the peritoneum or pleura.

According to Wesson, the mechanism of wound repair in the kidney is similar to that in any other parenchymatous organ. With the aid of a blood clot the proliferation of the interstitial connective tissue bridges the gap between the edges of the wound. The functional elements of the organ degenerate and are replaced by connective tissue. Scar formation in the kidney is rapid, and the process of repair shows marked advance in the course of a few days. The parenchyma is replaced by scar tissue through which scant, newly formed capillaries slowly permeate. There is no regeneration of the highly specialized tubules or glomeruli of the kidney. When the ruptures are numerous or extensive, cicatrization may cause a widespread fibrosis with ultimate atrophy of the kidney.

Hematuria is the most prominent symptom of injury of the urinary tract. It occurs in about 90 per cent of all cases of renal trauma. It may not occur when the injury is slight or when the rupture is not in communication with the excretory

apparatus. It may also be absent if the ureter or if the renal pedicle is completely torn, or if blood clots occlude the ureter. Hematuria, when present, is usually noticed at the first voiding following the injury, but may be delayed for several days. In amount it may be microscopic or profuse. Its duration may be very short, or it may be prolonged over a considerable period of time. When infection is present there is usually an associated pyuria.

When the injury is slight, tenderness only may be present in the general area of the trauma or about the kidney region, but pain is usually present, and varies in degree from moderate discomfort to intense agony. It is commonly increased by motion and by respiration and is localized chiefly to the area of the loin or of the upper abdomen of the same side; rarely is it contralateral. It may be due to contusion of the soft parts, to hematoma formation, or to a pull on the nerve-containing area of the renal pedicle. Colicky pain may result from the passage of blood clots down the ureter. An immediate, sharp, acute pain is fairly characteristic of rupture of the pelvis only.

Following injury of the kidney one may be able to palpate a mass of variable size in the renal area. This mass results from the accumulation of blood and/or urine in the perinephritic tissues, and may form a hematoma or a pseudohydronephrosis, and in the presence of infection, a perirenal cellulitis or a perinephritic abscess may result. The mass is ordinarily fixed, tender to pressure, and usually accompanied by a localized rigidity of the abdominal muscles, frequently associated with a flexion of the leg on the corresponding side. A more generalized rigidity is more apt to indicate extravasation of blood or urine into the abdominal cavity. The mass may develop with great rapidity, or it may form quite slowly, and in a general way, its size may be considered as an index to the degree of severity of the injury. In the absence of responsible factors no mass may develop.

Some diminution in the amount of urine passed is usually noted immediately following renal trauma. This is due to temporary suppression by the injured organ of secretion. It may also result from partial ureteral occlusion by blood clots or from injury to the ureter on the affected side. Complete anuria is not usual unless there is bilateral renal or ureteral injury. However, cases have been reported in which a reflex anuria with inhibition of secretion of the opposite side has been of such severity as to be the cause of death. Complete anuria might also be caused by injury to a solitary kidney or ureter. Blood clots forming in the bladder may cause a partial or complete retention of urine by obstruction of the bladder neck or urethra.

While nausea and vomiting may occur without shock, yet if the injury be severe the latter will usually develop. Immediate shock is regarded as due to injury to the nerve plexuses. However, shock which occurs after a lapse of several hours is usually resultant to extensive and persistent hemorrhage. Increasing anemia is indicated by a rapidly lowering blood count and hemoglobin determination. Infection is usually accompanied by fever, chills, and an increased leucocytosis.

Gastro-intestinal symptoms are usually reflex, resultant to trauma to the celiac plexus. If the peritoneum has been torn, blood and urine, or both, may flow into the peritoneal cavity, and in addition to the signs of internal hemorrhage, peritonitis may develop. This is rarely evident before twenty-four hours following injury. Even without such injury to the peritoneum, severe kidney injuries with shock may be accompanied by the so-called "renal ileus." In addition, injury of the various intra-abdominal viscera may still further complicate the picture. The differential diagnosis is sometimes very difficult, and a study of selected cases will emphasize the need of complete urological and urographic study.

Diagnosis involves not only the question of whether there is a renal injury, but includes also the problem of the determination of the site and extent of the trauma. Is hematuria, admittedly the cardinal symptom of renal injury, due to a traumatic lesion of the kidney itself, or is it resultant to an aggravation by the injury of a pre-existing pathological condition? Might hematuria in microscopic quantities be due to a condition not aggravated by, but brought to light by the examination incidental to trauma? The settlement of these questions depends upon a study of the data supplied by the history, by the symptoms, and by the general and special urological examinations made.

The history tells of the immediate accident, of the direction of the force, or of the type of penetrating instrument, and it may reveal a story of previous trouble, such as calculi or nephritis.

With or without external evidence of injury, a story of trauma with pain and tenderness in the kidney area and with hematuria makes us reasonably sure that there has been a definite renal injury. Palpation may reveal tenderness in the upper abdomen or in the lumbar region on the injured side, and deep costovertebral tenderness may also be elicited. The presence of oncoming muscular rigidity is suggestive. Palpation further reveals the size and extent of a developing hema-

toma, which, if large, always indicates severe hemorrhage. In the presence of muscular rigidity, percussion may help to outline the hematoma. It may determine, also, the presence of shifting abdominal dullness.

Urinalysis indicates the presence and extent of blood in the urine; it will also reveal the presence of pus or other evidence of urinary infection. A lowering of hemoglobin and of the blood count on repeated examinations is indicative of continued hemorrhage. In the interpretation the question of dehydration should be taken into account. While enlargement of the kidney shadow might indicate subcapsular hematoma; while distortion of the kidney shadow might indicate rupture and hematoma formation; and while a hematoma itself will sometimes tend to obscure the kidney outline, fade the line of the psoas, and occasionally cause a curvature of the spine, as frequently seen in cases of perinephritic abscess, a plain roentgenogram does not ordinarily give conclusive diagnostic evidence. Quite often details are obscured by the gas associated with a developing ileus. The roentgenogram is, however, of considerable value in portraying associated skeletal lesions.

Cystoscopy, pyelography, and urography are the special urological examinations on which we rely for a complete and accurate diagnosis. Cystoscopy may be contraindicated when the condition of the patient is such that immediate surgical interference is indicated. It could be omitted, also, in those cases of very evident minimal trauma. It is of especial importance in ruling out possible trauma of the lower urinary tract. Combined with intravenous injection of indigo-carmine it may afford valuable information relative to the functional activity of the injured or of the uninjured kidney.

Cystoscopy with ureteral catheterization and retrograde pyelograms is called for in certain cases in which operation may be anticipated. The source of bleeding, the functional and anatomical condition of the uninjured kidney, and sometimes of the injured kidney as well, can be determined. Objections to this procedure have been voiced because of the increased bleeding elicited by the ureteral catheter and because of the possibility of the introduction of infection, but there is little evidence to support these claims.

Before nephrectomy is done, the condition of the opposite kidney must be definitely ascertained, and if retrograde pyelography is not in order, intravenous pyelograms may be of great value. Intravenous pyelography is becoming accepted as a routine measure in every case of potential injury of the kidney, and in doubtful cases, it should be repeated. In the absence of shock this may be done immediately. The urogram may fail to show the kidney on the side of the injury, but the presence or absence of a functioning organ on the other side will be disclosed. Failure to visualize the injured kidney in the early stage is due to the fact that the injured and bleeding kidney may not secrete urine. In interpreting these urograms, reflex suppression of the secretion of the uninjured kidney and the occurrence of solitary kidney must be remembered. It is often of value to check the findings of excretory urography with those of retrograde pyelography. These two procedures are of paramount importance in determining the presence and extent of injury, in following the course of the case treated conservatively, in the follow-up of the postoperative case, especially when conservative surgery has been used, and in the study of the late complications and sequelæ which so frequently occur.

The treatment of traumatic injury of the kidney is classified as expectant or medical, and as surgical. The expectant or medical treatment is indicated in those cases in which constitutional symptoms are slight or absent, in which hematuria is the main symptom, and in which pyelography exhibits no extravasation. This expectant treatment consists essentially of rest in bed with mobilization of the injured parts, ice packs applied locally to the region of the kidney, and fluids and urinary antiseptics administered orally. Hemostatics which do not tend to raise the blood pressure may be prescribed. Catheterization is called for when obstruction develops in the lower urinary tract. Under such treatment many patients, probably the majority, recover, with an approximate restoration to normal of the afflicted parts. In these cases, on account of the complications which so frequently develop, follow-up urographic studies are urgently indicated.

Other cases do not respond so satisfactorily, and in these exploratory operation becomes necessary, with local and general conditions determining the type of operation to be done. In the presence of immediate or delayed severe hemorrhage, and with the development of an increasing hematoma, especially when accompanied by irregular fever and general signs of sepsis, exploration is warranted. In such cases there is usually a fall in blood pressure, a rising pulse rate, a decreasing hemoglobin determination, and an unsatisfactory general condition. The development of peritonitis, and the presence of a persistent anuria also call for operative procedures. In general, in the management of the acute case, it is usually not indicated to operate in the first few hours when

the patient is in severe shock, or when there are signs of rupture of the pedicle, of massive hemorrhage, of intraperitoneal involvement, or of injury of other organs. When immediate operation is necessary, such should be done only with accompanying stimulation to combat the existing shock. A careful balance must be struck as the majority of the operative deaths are due on the one hand to the severity of the primary injury, and on the other to procrastination in exploration.

For a not too severely damaged kidney or one with only a torn capsule, conservative surgery may be in order. The use of a tampon to control the bleeding may be sufficient. By some the tampon is condemned, as it is believed that it may lead to the formation of a permanent fistula, and in its place the use of a Mikulicz drain is recommended. This operation may also be indicated when the organ is more severely ruptured and when access to the renal pedicle is difficult, or when the patient's condition is quite critical. In this case, we would contemplate a secondary nephrectomy at a later date. A mild or moderately ruptured kidney may also be repaired by suture as one would do in nephrostomy. In many cases the use of ribbon catgut for tissue approximation has proved satisfactory. In other cases a partial resection or a classical heminephrectomy may fulfill the therapeutic requirements.

When nephrectomy is called for it is always essential to ascertain the condition of the other kidney. Cystoscopic studies may give this information, but are sometimes contraindicated when the patient's condition is critical. Excretory pyelograms may be diagnostic, but in an emergency it is always possible to open the peritoneum and palpate the opposite kidney. Complete nephrectomy is called for in cases of extensive destruction of the renal tissue and in cases with multiple deep lacerations. It is called for when the pedicle has been grossly torn or injured. It is further indicated with irreparable injuries to the kidney pelvis or ureter, and in cases with persistent or secondary hemorrhage. Because of shock and of exsanguination of the patient generally, and because of friable tissues, massive hematoma, and urinary extravasation locally, nephrectomy carries with it a certain hazard. If the kidney, as we have suggested before, is inaccessible, or delivery is difficult, or fresh hemorrhage from manipulation becomes too great, drainage with the placing of tampons, loose closure, and blood transfusion may save the patient. Nephrectomy has certain advantages over conservative surgery in eliminating the possibility of some secondary complications, as persistent urinary sinus, pus formation about the perirenal tissues, chronic pyelonephritis, continued infection with stone formation, and occasional secondary hemorrhage.

With associated injuries, particularly of the liver and spleen, the abdominal transperitoneal approach by midline or transverse incision is recommended. Abdominal exploration is indicated in those complicated cases in which localizing signs of renal injury, as hematuria, may be absent, and in which we find a condition of shock with vomiting, distention, weak and rapid pulse, perhaps increasing dullness in both flanks, increasing anemia, and often a primary leucocytosis. Severe cases of peritoneal injury rarely come to operation, as the blood escaping into the peritoneal cavity without counterpressure accumulates to the point where death soon ensues. Furthermore, when injury to the intraperitoneal viscera, to the diaphragm, or to the lungs is extensive, the patient usually succumbs quickly. In those cases in which laparotomy is necessary, many authorities recommend doing this part first, and then, when necessary, working on the kidney through a second incision in the lumbar area.

The treatment of external wounds of the kidney depends on the degree of injury and varies from cleaning and dressing to nephrectomy. The great mortality in these cases, which are less frequent than subcutaneous injuries, is due essentially to the frequent accompanying injuries of other organs. Infection is common, and treatment of this factor must be stressed. The symptoms differ in the presence of external hemorrhage and escape of urine from the wound, and in the lack, usually, of hematoma formation. The prognosis in uncomplicated cases is good.

In a study of this type morbidity as well as mortality merits careful consideration. The complications following expectant treatment and conservative surgical treatment of traumatic injury to the kidney are quite numerous. Cicatricial changes may occur which involve the calyces and the pelvis, and fibrotic changes may occur in the renal parenchyma itself. A pyelonephritis may develop and tend to become chronic. This and other septic complications can now be handled more favorably as the result of the recent introduction of more potent urinary antiseptics. This is a topic so vast in extent that we cannot go into detail. We would simply like to point out that, beyond question, mandelic acid and its salts, sulfanilamide, neoprontosil, sulfathiozol and allied compounds, and the revival of the use of neoarsphenamine have, in conjunction with the older urinary antiseptics, played an important part in lessening septic complications of renal trauma.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. E. J. F., female, aged seventeen. Automobile accident. Hematuria; hematoma; rapidly falling blood count and hemoglobin; failing general condition. Intravenous pyelography diagnostic. Recovery following nephrectomy for kidney split into approximately equal parts.

Fig. 2 M. R. R., male, aged thirty-two. Fall from a height. Shock; hematuria; hematoma following shock. Retrograde pyelogram shows ruptured kidney on injured side; associated pelvic fracture; recovery following nephrectomy for grossly infected kidney with multiple and deep lacerations about the lower pole.

Fig. 3. S. R., male, aged seventeen. Severe trauma eight years previously. Slowly increasing dysuria and pain in left kidney area. A functionless, infected hydronephrosis diagnosed. Nephrectomy performed.

Hydronephrosis may develop acutely from the blocking of the ureter by blood clots, but is more apt to develop slowly and chronically. It may result from a more or less complete division of the ureter close to the ureteropelvic junction with resulting stricture formation, but more frequently it is due to a periureteral inflammatory reaction with the formation of strictures, bands, and adhesions, particularly about the upper end of the ureter. Therapeutically, it is sufficient sometimes to liberate strictures and adhesive bands; sometimes a plastic operation is called for, combined with nephropexy when necessary; and in certain cases —more extensive in type—only nephrectomy will suffice.

Perinephritic changes occur in acute and chronic form. In the acute type there is increased pain, an increase in the size of the hematoma, a rise in the blood count with irregular pulse and fever, and in some cases definite perinephritic abscess formation. Drainage is called for, and it should be borne in mind that a secondary nephrectomy may become necessary. In some cases, however, inspection shows that future morbidity will be such that, the patient's condition permitting, a primary nephrectomy is more advantageous. On the chronic side, we may have the formation of a perirenal collection of fluid following hematoma absorption, and this may be found between the fibrous capsule and kidney or in the fatty capsule. According to the circumstances, drainage or primary nephrectomy may be in order. Sometimes a secondary nephrectomy has to follow the former.

In other cases fibrous perinephritic changes occur. When marked, these may even cause compression and ultimate atrophy of the kidney. They are apt to cause chronic pain. When these changes are not too far advanced, free liberation of the adhesions, sometimes combined with sympathectomy, is the indicated procedure. Traumatic strictures of the ureters are also noted, which, not yielding to cystoscopic treatment, may call for plastic reconstruction or for a nephrectomy. Pyonephrosis may develop, and in turn call for catheter drainage, plastic operation, nephrotomy, and a partial or complete nephrectomy.

What part trauma plays in the etiology of nephroptosis remains debatable, but there would seem to be certain cases of ptosis directly resultant to trauma. In medicolegal and industrial cases it is unfortunate that the burden of proof usually rests on disproving any connection between trauma and the resultant condition. Nephropexy may be called for when the kidney is movable to more than the first degree, and in cases in which pain is a prominent feature ureteral lysis

Fig. 4.

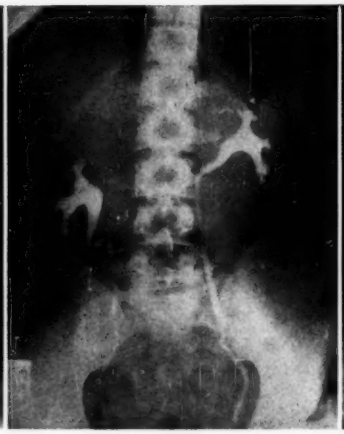


Fig. 5.

Fig. 6.

Fig. 4. H. L., male, aged twenty. Motorcycle accident. Hematoma followed by signs of sepsis. Loss of kidney outline; obliteration of psoas; concavity of spine to injured side. Recovery followed operative drainage.

Fig. 5. R. E. J., male, aged twenty-five. Fall, striking on back over right kidney area. Severe recurrently continued pain since injury. Pyelograms show marked ptosis. Relief from ureteral dilatation temporary. Pain relieved by lysis, sympathectomy, and nephropexy.

Fig. 6. M. R., male aged thirty. Urinary fistula of some duration followed pyelotomy and nephrolithotomy. Retrograde pyelography shows definite blockage at ureteropelvic area. Plastic repair suggested, but nephrectomy done elsewhere reported as satisfactory.

and renal sympathectomy combined with nephropexy have given brilliant results.

There are other possible complications. Urinary fistulas following conservative operation may necessitate nephrectomy. In such a case cure is obtained only by the removal of all of the secreting renal tissue. Calculus formation occasionally has a definite relationship to trauma, particularly when the nucleus of the stone is seen as a blood clot. Indirect trauma to the kidney associated with extensive bony fractures may also lead to the formation of kidney stones. Cysts, malignant growths, and tuberculous lesions have been occasionally ascribed to trauma. Treatment for this group may be medical or operative, and the latter may be conservative or may call for nephrectomy.

From the viewpoint of prognosis, the mortality of severe renal trauma has been estimated as between 15 and 20 per cent, with statistics slightly favoring operative treatment. The mild cases—the great majority—clear in a few weeks, with results which are usually permanently satisfactory. These cases, as well as the more severe ones, which have been treated expectantly or by conservative surgery, merit continued observation. Certainly, urographic studies, particularly excretory pyelograms, should be made at intervals of time over a period of at least a year. Retrograde studies and kidney functional tests are of importance when there is any doubt as to the patient's condition. It is only by following these cases in a proper and adequate manner that we can prevent or satisfactorily treat the numerous complications which develop as an aftermath of renal trauma. From the industrial or medicolegal viewpoint, the status of the apparently healed ruptured kidney is important. Wesson states that such kidneys are painless if they are in proper location and do not move with change of position, if the pelves are not distorted, and if the urine shows no pus, casts, nor organisms. Such a kidney should have a good phthalein function and should show no evidence of defective drainage. There should be no kidney pain unless there is an intrapelvic backpressure on the kidney.

In those cases in which nephrectomy has been necessary, either at the time of trauma or following later complications, the results should not be unfavorable to a normal span of life, as the remaining unaffected kidney still maintains considerably more kidney function than is necessary for normal activity.

In the past ten years we have encountered 43 cases of severe trauma of the kidney. These we have divided into two groups—acute and late. Of the former there were 18 cases. Nine of these were nephrectomized as the result of the immedi-

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. J. B., male, aged twenty. Thrown from horse six years previously, with direct injury to left kidney area. Apparent recovery. Urological study as result of pyuria. Calculi; pyonephrosis; practically functionless kidney. Total relief from nephrectomy.

Fig. 8. H. R., female, aged thirty. Indirect fall, several feet, with evident trauma to right kidney. Treated expectantly. Pyelographic study eight months later; ptosis; pyonephrosis; and ureteral kinking; functionless right kidney. Recovery following nephrectomy.

Fig. 9. W. W., female, aged forty-five. Recurrent left pyelitis following horseback injury fifteen years before. Patient positive all symptoms date from time of trauma. Pyelograms show constant stricture deformity at left ureteropelvic junction. Plastic attempted, but adhesions and stricturing so dense that nephrectomy was resorted to.

ate injury, and 9, of which 3 developed complications, were treated expectantly. Twenty-five patients in the so-called late group consulted us because of complications following previous renal injury. All of these gave a definite history of trauma. Three of them were treated medically, but 22 came to operation, conservative or radical, for the aftermath of renal trauma. In none of the 12 cases treated medically or of the 31 operated upon has there been any mortality.

Of the 9 cases in which nephrectomy was done for immediate renal trauma, 5 were personal and 1 was seen in consultation, and the records of the remaining 3 have been loaned by medical friends for statistical study. The patients in these cases have ranged in age from eleven to fifty-five years. Two have been of the female and 7 of the male sex. Sudden sharp trauma of one form or another was the common etiological factor. Bony fractures occurred as a complication in 3. In all cases a satisfactory end-result was obtained (Figs. 1 and 2).

In the group of 25 patients who developed complications following previous renal trauma, there were 3 with definite hydronephrosis. In 2 of these nephrectomy was necessary. In the third a plastic repair has given a very satisfactory result (Fig. 3). Trauma has twice been the etiological factor in the production of perinephritic abscess. In both of the cases the end-result of drainage proved satisfactory (Fig. 4). Four patients with renal ptosis gave a history of trauma so definite that we could not question the etiology. Over a period of time extreme renal destruction developed in 2, and nephrectomy was necessary. In the other 2, satisfactory results followed nephropexy (Fig. 5).

Renal damage necessitating nephrectomy followed operative injuries of the ureter with a resultant fistula in 4 cases. Two were associated with hysterectomy. One followed reconstructive repair of the ureter after injury during hysterectomy, and the fourth followed an unsuccessful ureteral transplantation. In all 4, relief was obtained by operation. (Several authors have recommended the placing of ureteral catheters preliminary to any operation in which the removal of the uterus is contemplated.)

In 5 cases surgical trauma led to later nephrectomy. In one, calculi were removed from the kidney twice, and in another three times before nephrectomy was resorted to. The third case developed cortical abscesses following nephrolithotomy. In the 2 others persistent urinary fistulas followed operative removal of the renal stone (Fig. 6).

There were 2 cases of renal calculi following trauma. Multiple renal calculi followed multiple

fractures of the long bones in one case, and these were gradually passed with the aid of repeated cystoscopic maneuvers. In the other case initial trauma followed by continued infection and the formation of calculi led to such extensive renal destruction that nephrectomy was called for (Fig. 7). Only 1 case of definite pyonephrosis in which the etiology could be convincingly traced to trauma has come to operation, and in this case nephrectomy was necessary (Fig. 8).

There was 1 case of definite stricture of the ureter; in this case an attempted plastic repair could not be done, and therefore nephrectomy was performed (Fig. 9). Extensive bilateral pyonephrosis and pyo-ureter developed in 2 cases following indirect trauma from fractures of the spine. Neurological changes were present in both. Treatment was expectant (Fig. 10).

There was 1 case in which an operation for the removal of renal calculus was followed two years later by nephrectomy for a carcinoma of the kidney. This pathology was not present at the time of the first operation. We, ourselves, doubt whether the initial surgical trauma was responsible for the occurrence of the new growth, but we have especially listed this case to point out the fact that in all of the others of this series of 43 we were personally definitely convinced that trauma was the main causative factor for the injury and for the pathology found.

In addition, there were 9 cases in which the renal trauma was of such severity that operation was definitely contemplated, although conservative treatment was ultimately decided upon. All of the patients made an apparent recovery from the primary injury. Follow-up studies have been made on 7. One shows a definite ureteral stricture; the second, ureteral strictures and kinks; and the third, a beginning hydronephrosis. The remaining 4 show essentially negative intravenous pyelograms.

In conclusion, we have reviewed the literature of the past few years in an endeavor to bring out and to clarify what there is new in the clinical management of renal trauma. There is an increasing incidence of kidney injury as the result of automobile accidents. There appears, also, though this may be due to greater frankness on the part of reporting authors, a more frequent occurrence of trauma associated with pyelographic studies, cystoscopic instrumental maneuvers, and operative surgical work.

We encountered no new pathological contributions of importance. The condition has previously been well classified by different authors. The classical symptoms of hematuria, pain, hematoma, anuria, shock, and peritoneal reflex remain unchanged.

Fig. 10. J. W., male, aged nineteen. Broken back. Complete initial retention followed by later overflow incontinence. Marked pyuria; beginning cord bladder, confirmed cystometrically; pyonephrosis and pyo-ureter on both sides. Treatment expectant.

As to diagnosis, excretory urography, a development of the past few years, is of vital importance. Its use in the study of cases of renal trauma is becoming practically routine. In a percentage of cases, however, retrograde pyelography is of greater value. Interpretative studies by either method or by a combination of the two lead, first, to diagnosis of the presence of trauma and then to determination of its site and extent. Urographic studies are of immense value in the follow-up of cases treated medically and by conservative surgery, and they are of tremendous importance in depicting the different types of complications which frequently occur as an aftermath of renal trauma.

In treatment, while an analysis of our own cases does not particularly emphasize the fact, we find a growing tendency toward conservatism, both in the general management of the case and in the type of surgery used. New operative techniques, particularly adaptable to the conservative surgical treatment of trauma, are described. Indications for and against more radical types of surgery are evaluated. Numerous reports show that the use of the newer urinary antiseptics has reduced the incidence of, and helped in the treatment of both acute and chronic infections associated with renal trauma.

Prognosis deals with both mortality and morbidity. There is, seemingly, in later years, a less-

ening of the death rate due to renal trauma. On the other hand, we note an astoundingly large group of complications occurring as an aftermath of renal injury. Hydronephrosis, perinephritic abscess, chronic perirenal fibrous changes, nephroptosis, stone formation, urinary fistulas, and strictures and kinks of the ureter, are mentioned. For these conditions the preferable treatment whether conservative or radical, has been analyzed, and we draw your attention to the fact that such treatment, late to be sure, is, nevertheless, a part of the picture of renal trauma.

We have presented and statistically analyzed 43 cases of severe trauma to the kidney. Twelve of these were treated medically; 9 were acute and 3 of the type illustrating the late effects of kidney injury. There were 31 operative cases, in 5 of which relief was obtained by conservative surgery. These were all of the type presenting late complications of renal trauma. Nephrectomy was necessary in 26 cases, in 9 because of the acute symptoms following immediate trauma, and in 17 of the late type because of a complicative aftermath. In our total of 43 cases treated, there was no mortality.

BIBLIOGRAPHY

1. Abeshouse, B. S. Rupture of Kidney Pelvis; Review of Literature. Surg., Gynec. & Obst., 1935, 60: 710.
2. Allen, C. D. Notes on Nephrostomy Drainage. Urol. & Cutan. Rev., 1935, 39: 389.
3. Arrues, L. D., and Bottini, E. B. Renal Tuberculosis and Traumatism. Rev. argent. de urol., 1937, 6: 497.
4. Backus, H. S. Traumatic Rupture of the Kidney. New England J. Med., 1934, 211: 563.
5. Bailey, H. Plastic Operations for Hydronephrosis. Brit. M. J., 1936, 2: 669.
6. Idem. Surgical Emergencies of the Kidneys. Practitioner, 1933, 130: 342.
7. Baretz, L. H. Rupture of the Kidney Following Pyelography. J. Am. M. Ass., 1936, 106: 980.
8. Barnes, R. W. Acquired Renocolic Fistula. J. Urol., 1933, 29: 111.
9. Beer, E., and Mencher, W. H. Heminephrectomy in Disease of Double Kidney. Ann. Surg., 1938, 108: 705.
10. Binger, M. W. Renal Emergencies. Med. Clin. North Am., 1938, 22: 949.
11. Blinick and Wilhelm. Hydronephrosis—Pelvic Plication. Am. J. Surg., 1937, 37: 90.
12. Bobbitt, R. M. Extrinsic Causes of Hydronephrosis. J. Urol., 1937, 38: 562.
13. Braasch, W. F., and Emmett, J. L. Excretory Urography as a Test of Renal Function. J. Urol., 1936, 35: 630.
14. Braasch, W. F., and Merricks, J. W. Clinical and Radiologic Data Associated with Congenital and Acquired Single Kidney. Tr. Am. Ass. Genito-Urin. Surg., 1937, 30: 103.
15. Brattström, E. Traumatic Rupture of the Kidney in a Case of Unilateral Congenital Agenesis. Acta chirurg. Scand., 1932, 71: 151.
16. Brinkman, J. E. Renal Aneurysm. J. Iowa State M. Soc., 1934, 24: 84.
17. Bugbee, H. G. Perinephritis and Perinephritic Abscess. Am. J. Surg., 1934, 26: 255.
18. Cabot, H., and Thompson, C. J. Reparative Operation on Kidney and Ureter. Surg. Clin. North Am., 1935, 15: 1137.
19. Campbell, M. Pediatric Urology. New York: The MacMillan Company, 1937.
20. Char, Shih and Wen. Heminephrectomy. J. Urol., 1936, 36: 305.
21. Chwalla, R. Fremdkorper im Nierenbecken. Wien. klin. Wchnschr., 1935, 48: 1210.
22. Colston, J. A. C., and Baker, W. W. Late Effects of Various Types of Trauma to the Kidney. Tr. Am. Ass. Genito-Urin. Surg., 1935, 28: 171.
23. Coppridge, W. M. Spontaneous Subcapsular Renal Hematoma. J. Urol., 1938, 39: 733.
24. Corcoran, W. J. Intravenous Urography in Injuries to the Genito-urinary Tract. Radiology, 1935, 25: 231.
25. Crabtree, E. G. Hydronephrosis of Pregnancy. J. Urol., 1937, 38: 605.
26. Davis, D. M. Conservative Methods in the Surgery of the Chronically and Severely Infected Kidney. New England J. Med., 1938, 218: 947.
27. Davis, G. G. Trauma to the Kidney. Illinois M. J., 1933, 63: 554.
28. Davis, R. L., and Cowles, A. G. Perinephritic Abscess. J. Urol., 1936, 36: 327.
29. Desjaques, R. Ruptured Left Kidney Associated with Splenic Injury. Lyon chir., 1936, 33: 510.
30. De Vincentiis, A. Nephrotomy with the Electric and the Ordinary Scalpel. Arch. ital. di urol., 1937, 14: 386.
31. Dodd, H. Abdominal Nephrectomy for Ruptured Kidney. Brit. M. J., 1932, 2: 54.
32. Dougherty, J. A. Solitary Kidney. California & West. Med., 1937, 47: 307.
33. Dozsa, E. Ueber die subcutanen Nierenverletzungen und deren Spaetfolgen. Ztschr. f. urol. Chir. u. Gynaek., 1936, 42: 222.
34. Edmunds, P. K. Traumatic Rupture, Left Renal Artery with Injury to the Kidney. J. Am. M. Ass., 1932, 99: 467.
35. Eisendrath, D., and Rolnick, H. Urology. Philadelphia: J. B. Lippincott Company, 1938.
36. Eisendrath, D. N. Hydronephrosis Occurring as a Late Sequel to Kidney Injury. J. Am. M. Ass., 1935, 104: 1895.
37. Emmett, J. L. (Discussion by Cabot, H.). Technical Points to Promote Safety in Manipulation of Ureteral Stone. Proc. Staff Meet., Mayo Clin., 1937, 12: 449.
38. Ericksen, L. G. Rupture of Solitary Kidney. Am. J. Roentgenol., 1938, 39: 731.
39. Ewell, G. H. Traumatic Rupture of a Hydronephrotic Kidney. J. Urol., 1933, 29: 685.
40. Idem. Value of Excretory Urography in Traumatic Injuries of the Urinary Tract. Urol. & Cutan. Rev., 1935, 39: 700.
41. Falk, R., and Smith, R. Nephrectomy 25 Years after Uretero-Sigmoid Anastomosis. Northwest Med., 1938, 37: 353.
42. Farman, F. Diagnostic and Operative Factors in Traumatic Rupture of the Kidney. J. Am. M. Ass., 1940, 114: 210.
43. Findlay, F. M. The Treatment of Ruptured Kidney, with Case Report. West. J. Surg., Obst. & Gynec., 1936, 44: 117.

44. FLYNN, R. Gunshot Wound of Kidney. Med. J. Australia, 1936, 1: 367.
45. FOLEY, F. E. B. Plastic Operation for Stricture at the Ureteropelvic Junction. J. Urol., 1937, 38: 643.
46. FOULDS, G. S., and VAREY, D. H. Extravasation of Urine from the Ureter Secondary to Ureteral Calculus. Brit. J. Urol., 1934, 6: 27.
47. GAUDIN, H. J., and CABOT, H. Re-establishment of Function in the Chronically Non-Functioning Kidney after Removal of Obstruction. Proc. Staff Meet. Mayo Clin., 1938, 13: 388.
48. GOLDSTEIN, A. E. Accidents in Renal Surgery. Surg., Gynec. & Obst., 1937, 65: 512.
49. GOLDSTEIN, A. E., and ABESHOUSE, B. S. Partial Resection of the Kidney. J. Urol., 1937, 38: 15.
50. Idem. Urinary Calculi in Bone Diseases; Review of Literature and Report of Cases. Arch. Surg., 1935, 31: 943.
51. GRAVES, R. G., and KICKHAM, C. J. E. Urologic Complications of Carcinoma of the Cervix. Am. J. Surg., 1937, 38: 168.
52. GUTIERREZ, R. Cabot's Modern Urology. Philadelphia: Lea and Febiger, 1936.
53. Idem. Nephrostomy as a Preliminary Drainage in Preparation for Secondary Nephrectomy. J. Urol., 1934, 31: 305.
54. HAND, J. R. Surgical Lesions of the Kidney Requiring Nephrectomy. Northwest Med., 1937, 36: 430.
55. HARRIS, A. Plastic Operations on the Kidney. Ann. Surg., 1935, 102: 1050.
56. Idem. Problem of Non-Calculous Ureteropelvic Obstruction. Ann. Surg., 1935, 102: 1050.
57. HARROLD, R. D. Present Status of Oral Administration of Antiseptics. Urol. & Cutan. Rev., 1938, 42: 555.
58. HELMHOLZ, H. F. Ascending Infection of Urinary Passages. Am. J. Surg., 1937, 38: 18.
59. HENLINE, R. B. Cause and Treatment of Non-Calculous Uretero-Pelvic Obstructions with Report of 66 Operated Cases. J. Urol., 1935, 34: 584.
60. Idem. Discussion of Graves, Kickham, and Nathanson: "Ureteral & Renal Complications of Carcinoma of the Cervix." J. Urol., 1936, 36: 640.
61. Idem. Traumatic Injuries of Upper Urinary Tract Following Instrumentation. J. Am. M. Ass., 1934, 102: 182.
62. HERMAN, L. The Practice of Urology. Philadelphia: W. B. Saunders Company, 1938.
63. HERMANN, H. B., and HERMANN, N. R. Rupture of the Kidney. Urol. & Cutan. Rev., 1937, 41: 845.
64. HESS, E. Heminephrectomy. J. Urol., 1937, 38: 43.
65. Idem. Nephrotomy. California & West. Med., 1934, 41: 73.
66. Idem. Renal Mobility. J. Am. M. Ass., 1938, 110: 1818.
67. Idem. Renal Surgery—Postoperative Morbidity. West J. Surg., Abst. & Gynec., 1937, 45: 168.
68. HINMAN, F. Principles and Practice of Urology. Philadelphia: W. B. Saunders & Company, 1935.
69. HIRSCH, E. W., and BASS, H. Renocolic Fistula. J. Urol., 1937, 38: 371.
70. JONES, F. F. The Surgical Treatment of Transcapsular Rupture of the Kidney. Am. J. Surg., 1936, 34: 76.
71. KINDALL, L. E. Conservative Renal Surgery, with Particular Reference to Kidney Trauma. California & West. Med., 1938, 9: 115.
72. KRETSCHMER, H. L. Resection of the Kidney. Surg., Gynec. & Obst., 1935, 60: 984.
73. Idem. Partial Resection of the Kidney. Tr. Am. Ass. Genito-Urin. Surg., 1934, 27: 249.
74. LAFFITTE, M. Long Stay of Foreign Body in Kidney. J. d'urol. méd. et chir., 1936, 42: 565.
75. LANDMANN, H. A Contribution to the Question of Renal Complications in Tuberculosis of the Bones and Joints. Schweiz. med. Wchnschr., 1938, p. 200.
76. LEARMONTH, J. R. Certain Problems of Urinary Infection in Practice. Edinburgh M. J., 1937, 44: 385.
77. LEVY-DREYFUS, R. Intestinal Fistulas after Operations on Renal and Perirenal Tissues. J. d'urol. méd. et chir., 1937, 44: 5.
78. LIVERMORE, G. R. Value of Nephrostomy and Decapsulation in Anuria. J. Am. M. Ass., 1937, 109: 1528.
79. LOWSLEY, O. S., and BISHOP, C. C. New Method of Repairing Kidney Wounds. Surg., Gynec. & Obst., 1933, 57: 494.
80. LUBASH, S., and MADRID, A. Uretero-Pyelo-Neostomy for Hydronephrosis; with Case and Experimental Reports. J. Urol., 1937, 38: 634.
81. MAGOUN, J. H. Hydronephrosis Due to Ball-valve Obstruction from Bullet Lying free in Renal Pelvis. Am. J. Surg., 1937, 36: 717.
82. MATHE, C. P. Conservative Surgery of the Kidney. Urol. & Cutan. Rev., 1938, 42: 7.
83. Idem. Diagnosis and Treatment of Perinephritic Abscess; Renal Fixation; A New Roentgen Diagnostic Sign. Am. J. Surg., 1937, 38: 35.
84. Idem. Intrinsic Causes of Hydronephrosis. J. Urol., 1937, 38: 574.
85. Idem. Nephropexy. End Results in 384 Operative Cases. Urol. & Cutan. Rev., 1937, 41: 772.
86. Idem. Two-Stage Nephrectomy. Tr. West. Branch A. U. A., 1937, 6: 3.
87. MATHE, C. P., and DE LA PENA, E. Surgical Repair of Hydronephrosis with Reference to Technical Points Favoring Relief. J. Urol., 1934, 31: 1.
88. MCCAGUE, E. J. Incidence and Prevention of Renal and Vesical Calculi in the Fracture and Traumatic Group. Am. J. Surg., 1937, 38: 85.
89. MCKAY, R. W. True Aneurysm of Renal Artery. J. Urol., 1937, 37: 783.
90. MCKENNA, C. M. Diagnosis and Management of Traumatic Lesions of the Genito-Urinary Tract. Internat. J. Med. & Surg., 1934, 47: 69.
91. Idem. Neoskiodan in Suspected Injuries to Genito-Urinary Tract. J. Am. M. Ass., 1934, 102: 599.
92. MERTZ, H. O., and HAMER, H. G. 167 Cases of Urology in Children. 5 Renal Injuries. J. Urol., 1938, 39: 548.
93. MOORE, T. D. Diagnosis and Management of Hydronephrosis Secondary to Ureteropelvic Obstruction of Non-Calculous Type. Am. J. Surg., 1937, 38: 101.
94. OCKERBLAD, N. F. Experimental Studies with Viable Muscle Grafts in Kidney Surgery. South. M. J., 1934, 27: 1.
95. O'CONOR, V. J. Nephrolysis, Ureterolysis and Nephropexy; Analysis of Seventy-Six Patients Operated upon by a Similar Technic. Urol. & Cutan. Rev., 1938, 42: 552.
96. ORMOND, J. K. Unsuccessful Plastic Operations for Hydronephrosis. J. Urol., 1936, 36: 512.
97. PEACOCK, A. H. Hydronephrosis; Etiology and Management. J. Urol., 1937, 37: 63.
98. POWERS. Renal Function After Trauma. New York State J. M., 1936, 36: 1411.

99. PRATHER, G. C. Traumatic Conditions of the Kidney. J. Am. M. Ass., 1940, 114: 207.
100. RATHBUN, N. P. Transabdominal Extraperitoneal Nephrectomy. Tr. Am. Ass. Genito-Urin. Surg., 1935, 28: 139.
101. ROLNICK, H. C. Nephrostomy; Some Clinical and Experimental Observations. Surg., Gynec., & Obst., 1938, 67: 224.
102. Idem. Observations on the Renal Capsule. J. Urol., 1937, 38: 421.
103. Idem. Pyelography in Injuries to the Kidney. Am. J. Surg., 1933, 20: 40.
104. RUSCHE, C. F., and BACON, S. K. Injury of the Ureter. J. Am. M. Ass., 1940, 114: 201.
105. SCHENCK, G. F. Traumatic Rupture of the Kidney. California & West. Med., 1934, 40: 341.
106. SCHULHOF, M. G. The Effect of Surgical Drainage on Kidneys Declared Functionless by Present Tests of Renal Function. Surg., Gynec. & Obst., 1937, 65: 188.
107. STIRLING, W. C. Delayed Extensive Peri-renal Extravasation of Urine Following Traumatic Injury to the Kidney. M. Ann. District of Columbia, 1934, 3: 41.
108. STIRLING, W. C. Traumatism of the Kidney. Brit. J. Urol., 1936, 8: 1.
109. STIRLING, W. C., and LANDS, A. M. Blood Findings and Renal Function Test in Kidney Trauma: An Experimental Study. South. M. J., 1937, 30: 225.
110. STRAND, F. Perforation of the Pelvis During Ureteral Catheterization. Ztschr. f. Urol., 1937, 31: 612.
111. SWEETSTER, T. H. A Contribution on the Management of Kidney Injuries, with Special Reference to the Value of Intravenous Pyelography. Minnesota Med., 1935, 18: 283.
112. THOMSON, W. J. Surgical Diseases of the Genito-Urinary Organs. Baltimore: William Wood & Company, 1936.
113. TURTON, J. R. H., and WILLIAMSON, J. C. F. L. Traumatic Rupture of the Congenital Solitary Kidney. Brit. J. Surg., 1935, 23: 327.
114. WALTERS, W. Plastic Operations on the Genito-Urinary Tract: I. Operation on the Ureters and Kidneys. Proc. Staff Meet. Mayo Clin., 1935, 10: 529.
115. WALTERS, W., CABOT, H., and PRIESTLEY, J. T. Operative Results in Non-Calculous Hydronephrosis; Results in Seventy-One Plastic Operations. J. Urol., 1937, 38: 688.
116. WESSON, M. B. New Pyelographic Technique. Am. J. Surg., 1934, 23: 284.
117. Idem. Renocolic Fistulae. Tr. Am. Ass. Genito-Urin. Surg., 1937, p. 159.
118. WESSON, M., and RUGGLES, H. Urological Roentgenology. Philadelphia: Lea and Febiger, 1936.
119. WHARTON, L. R. Transperitoneal Nephrectomy for Malignant Tumors of the Kidney. Surg., Gynec. & Obst., 1935, 60: 689.
120. WOOD, A. H. Diagnosis and Treatment of Trauma to the Kidney. J. Urol., 1937, 37: 437.
121. Idem. Management of Trauma to the Kidney. Surg. Clin. North Am., 1936, 16: 1231.
122. YOUNG, H. H., and DAVIS, D. M. Young's Practice Of Urology. Philadelphia: W. B. Saunders Company, 1926.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

González, R.: The Mechanism of Pyelovenous Reflux; Investigation and Results (El mecanismo del reflujo pielo-venoso: investigación y resultados). *Bol. y trab. Soc. de cirug. de Cordoba*, 1940, 1: 10.

The object of the experiments of González was to determine the mechanism of production of the reflux, the site at which the reflux takes place, and the pressure under which it occurs. He used healthy, adult rabbits, all of about the same age, which had not been submitted to previous experiments capable of altering the structure of the kidneys. The experiments were made on both kidneys. Each animal was killed and bled by section of the carotid artery, and the abdomen was opened to expose the ureters and kidneys. The renal veins and the ureters were isolated, the ureter being sectioned 4 or 5 cm. from the renal pelvis, and a cannula was installed to be connected with a syringe and manometer; the renal vein was cut to allow free flow of the reflux fluid and thereby to avoid counterpressure. A solution of methylene blue was then injected until pyelovenous reflux occurred and the pressure needed for the purpose was noted; the solution of methylene blue was then replaced by one of Chinese ink, and the kidney was removed and fixed in 20 per cent formaldehyde for subsequent histological study. A colored gelatine solution was used instead of Chinese ink in some cases. The same technique was employed for human kidneys, but a colored gelatine or celluloid solution served for the injection.

Study of the preparations showed that the reflux does not always occur at the fornix, as claimed by some authors, but may take place in the wall of the calyx below the fornix; and that it does not consist of an infiltration of the connective tissue but of a passage of the injected substance through the wall of the calyx into the venous system; the arterial system does not participate in this process. It would seem that, in addition to the pressure capable of distending the walls of the renal pelvis, a special structural predisposition of the tissues of still unknown nature is needed to make the reflux possible. Taking into account the secretory pressure of the kidney, it has been found that average or even lower pressure was capable of producing the reflux, while higher pressure caused parenchymatous extravasation, especially in the upper pole of the kidney. Slow and continuous pressure for a period varying between ten and thirty seconds, under manometric control with the apparatus used by the author, produced the reflux without danger of extravasation.

Pyelovenous reflux is thus an established fact and may occur systematically under certain conditions. Those who have studied the question agree that it is a mechanism by which the kidney guards itself against atrophying pressure when the excretory tract is blocked sufficiently to raise the intrapelvic pressure to a dangerous degree. From the clinical point of view, the pyelovenous reflux helps to explain the mechanism of hydronephrosis for which it has been necessary to accept some kind of resorption; as it has been impossible to demonstrate any tubular resorption of the pelvic contents, and there are anatomical and physiological reasons to deny it, the presence of an ampler route must be accepted to explain the pathogeny of the disorder. Then there is no doubt that pyelovenous reflux is the cause of certain incidents observed in pyelograms which have been accepted as extravasations of opaque substance because of excessive pressure during its injection.

The author has also observed the inverse phenomenon, venopyelic reflux. It cannot be obtained directly, but only after a pyelovenous reflux has first been established. It is on this basis that Hinman has given a physiopathological interpretation of the intermittent hemorrhages of hydronephrosis.

RICHARD KEMEL, M.D.

De Freitas, R.: Conservative Surgery in Surgical and Medical Nephropathies (A cirurgia conservadora nas nefropatias: cirúrgicas e médicas). *Arq. de cirurg. clín. e exper.*, 1940, 4: 113.

In this comprehensive and profusely illustrated work, De Freitas discusses the radius of action of conservative surgery of the kidney in general and gives a list of its indications, pointing out that surgery invades the field of medical nephropathies in cases in which the lesions are progressive and irreversible by clinical treatment and lead to certain destruction of the organ by glomerular asphyxia, or in cases in which the symptom of hypertension is so alarming and refractory to the usual treatment that it can by itself cause grave or lethal accidents or lead to renal sclerosis. The author presents a short study of the various renal disorders placed on his list in order to justify his classification and to mention the adequate conservative surgical measures in each case.

He discusses nephroptosis; pyelorenal suppurating processes, including pyelitis, pyelonephritis, pyonephrosis, renal abscess, carbuncle, and perinephritis; the pyelo-ureteral neuromuscular problem, its physiological and physiopathological aspects, and the neuromuscular disorder of the excretory tract; hydronephrosis; reno-ureteral lithiasis; renal and pyelo-ureteral congenital and acquired anomalies; and medical nephropathies.

Nephropexy is indicated in nephroptosis; it may be direct (parenchymatous, capsular, or plastic) or indirect, but preference is given to the direct process by transfixion of the kidney with catgut sutures which are tied to the lumbar muscle (Papin's method without decapsulation). When decapsulation is indicated, as in chronic pyelonephritis and painful

syndrome, the polar nephropexy of Von Lichtenberg is used. In pyelic dilatations, corrective plastic interventions are indicated. When necessary, adhesions due to chronic perinephro-ureteritis are liberated (nephro-ureterolysis). The treatment of renal lithiasis includes ureterolithotomy, pyelolithotomy, nephrolithotomy, and nephrostomy, according to cases. Nephrotomy is used in anuria, with or without omentization of the kidney. Nephrostomy has many indications: in infected hydronephrosis as a temporary or final measure or as a preparation for nephrectomy; in rebellious pyelorenal infection and infected renal lithiasis. Decapsulation and denervation (surgical, chemical, periarterial, or total) serve as complements to other surgical interventions in pyelorenal infection and lithiasis, or as curative or palliative treatment in medical diseases of the kidney, benign or malignant arterial hypertension, painful renal crises without substratum, angioneurotic hematuria and secretory anuria. Suprarenalectomy (never bilateral) and section of the splanchnic nerves are also employed in arterial hypertension.

The lumbar route is used for all renal surgery through a large oblique incision with resection of the twelfth rib; the different planes are sutured individually and the patient is kept immobilized for a considerable time. Drainage of the renal pelvis is instituted only in pure infections or those associated with lithiasis and in hydronephrosis when nephrostomy is indicated. Drainage of the renal lodge is used in nephrectomy for tuberculosis or cancer and in laborious interventions on infected kidneys. The techniques for high derivation of the urine are usually operations imposed by necessity and their results are generally bad, but they allow prolonged survival in subjects with grave nephropathies. Segmental, peridural anesthesia (Dogliotti's method) gives satisfactory results. RICHARD KEMEL, M.D.

Oberholtzer, A.: A Clinical and Experimental Contribution to the Study of Renal Hemostasis by the Interposition of Tissues (Contributo clinico e sperimentale allo studio della emostasi renale per interposizione di tessuti). *Policlin.*, Rome, 1940, 47: sez. chir. 400.

The most difficult problem in nephrotomy and partial kidney resection is the control of hemorrhage. The blood pouring out of the gash has to be stopped carefully and definitely if a much undesired secondary nephrectomy is to be avoided.

The author, rejecting all other methods, emphasizes the interposition of tissues between the bleeding surfaces of the wound produced by operation. Various kinds of tissue have been recommended but Oberholtzer does not approve of all of them. He especially prefers fresh muscle tissue as it is immediately available; its chemical constitution gives the best guarantee of a styptic effect; it is easily absorbed; and it gives a specific stimulus to the neighboring parts to fill in with new connective tissue.

Some authors, however, have warned that these insertions might inflict damage to the parenchyma of the organ and that adjacent or even more extended parts of the cortex might be exposed to calcareous degeneration. Oberholtzer has tried to solve the problem experimentally and clinically.

The author performed nephrotomy and partial resection in rabbits, inserting strips of tissue between the bleeding surfaces of the cut (for the most part fresh muscle of the operated animal, otherwise preserved muscle or catgut treads). He used sutures of finest catgut to fix the inserted pieces and to close the gash. The results were satisfactory, bleeding having ceased promptly and completely. Secondary bleeding did not occur. After some time the inserted tissue was completely resorbed, and the final result was a small scar not disfiguring to the kidney. Never have grave degenerative consequences been found, such as hydronephrosis, diffuse sclerosis, or calcification. The incorporated strips never became encysted; their total absorption took from thirty to fifty days. In a small zone on both sides of the cut, there was a degeneration of the parenchyma, and in a few cases, calcareous deposits were detected, but the degeneration did not tend to expand. Initial slight infiltration and vasodilatation in more distant parts soon receded.

The clinical observations of the author deal with 21 patients operated upon by nephrotomy or partial resection, for the most part on account of calculosis. Strips of fresh muscle were inserted to control hemorrhage and then the fibrous capsule was sewed together; in a few cases sutures were drawn through parenchymatous parts, and the most vulnerable spots were protected from the catgut with small lumps of fat. Bleeding ceased almost immediately: not later than on the third day after operation did the last trace of blood disappear from the drainage and the urine. The kidney functioned postoperatively as well as or better than before the operation. Periodical roentgenographic examination showed the absence of calculi as well as of calcifications within the whole region of the kidney in question. Special methods such as urography, pyelography, and the use of a ureteral catheter proved that the function of the operated kidneys had not been disturbed. In 1 case death from bronchopneumonia occurred after twenty-one days; histological examination showed no sign of calcification or progressing sclerosis.

Oberholtzer comes to the conclusion that nephrotomy with the control of hemorrhage by means of inserted pieces of fresh muscle is a safe operation capable of keeping the kidney in good anatomical and functional condition. NELDA CASSUTO.

BLADDER, URETHRA, AND PENIS

Lederman, M.: Radium Treatment of Cancer of the Penis. *Brit. J. Radiol.*, 1940, 13: 393.

The divergence of opinion in the treatment of cancer of the penis may be partly accounted for by the existence of certain locational and histological features of cancer of the penis which render complex

such problems as would normally present themselves for consideration in the treatment of skin cancer. These special features are as follows:

1. The majority of epitheliomas of the penis are infected, and histologically well differentiated and keratinizing in type, these factors tending toward radioresistance.

2. The skin and mucous membrane forming the fold of prepuce and covering the glans appear to be much more susceptible to damage by radiation than are such surfaces elsewhere. Furthermore, the skin of the groins appears to be unable to withstand reasonably heavy dosages of radiation, the normal warmth and moistness of these areas possibly accounting in some measure for this fact.

3. Lymph-node metastases are not uncommon and tend to be bilateral, the penis being a midline structure. These metastases respond poorly to radiotherapeutic treatment, since they are not only of a radioresistant type histologically, but are also often infected.

Until 1936 the treatment given to the primary disease at the Royal Cancer Hospital, London, was in the majority of cases by means of a molded applicator. The treatment was limited to the diseased area and a wide margin of surrounding healthy tissue. The filtration employed was 1 mm. of platinum equivalent, the radium skin distance was 0.7 cm., and the dosage varied from 1.2 to 2 m.c.d. per sq. cm., as it depended on the type of lesion and the size of the area treated. When interstitial irradiation has been employed, and needles of varying lengths with a linear density of 0.66 mgm./cm. and 0.5 of platinum filtration have been available, the duration of treatment was one hundred and sixty-eight hours and the amount of radium used depended on the size of the lesion.

With some exceptions the inguinal lymphatic regions have at all times been treated by 1 gm. of teleradium therapy following the principles laid down by the Radiumhemmet. Two 1 gm. units (the details of which are given below) have been available, and doses varying from 14 to 28 gm. hours per field and spread over a period of from three to six weeks have been given, the dose depending on general and local tolerance, the number of fields used, and the extent of the lymph-node involvement. In modern notation this would correspond to surface dosages of from 2,660 to 5,320 roentgens.

Present teleradium technique has been consistent for the past three years, and its principles are:

1. To irradiate homogeneously the glans and major part of the shaft of the penis. A distance of 5 or 6 cm. from the tip of the glans proximally has been considered an adequate length. In support of the value of irradiation of the shaft of the penis, Hutchinson mentions that, although a recurrence in a remote part of the shaft is unlikely, it is often difficult to estimate the extent of the local disease in the presence of sepsis and edema, and "when it is a question of assessing the utility of any technical procedure it is a wise precaution to ensure that the unsuccessful case can never be due to failure to include every portion of the growth within the zone of lethal irradiation."

2. The lymphatic drainage areas are treated adequately, whether palpable nodes are present or not. The lymphnodal tissue present in the region of the saphenous opening is included in the treatment area.

3. A fractionated method of delivering dosage is employed, and the treatment to the primary lesion and the lymph-node areas is concurrent.

In the series of cases under discussion, radium therapy was in all instances the procedure employed in the treatment of the primary disease, although the technical methods of application varied. A brief résumé of the results obtained by these different methods is of interest.

The radium applicator was used in 14 cases. In 7 primary healing was obtained, and of the remaining 7, 2 were so advanced that the treatment had to be regarded as palliative, and 5 showed persistent residual ulceration or thickening after treatment. Seven partial amputations were performed, 2 for recurrence after primary healing, four years and one year after treatment (both sections positive), and 5 for residual ulceration or thickening within from five to ten months of treatment. In these 5 cases, 2 positive and 3 negative sections were obtained.

Teleradium was used in 10 cases. Primary healing was obtained in all cases. With but 1 exception there were no local recurrences, and no surgical intervention was necessary. It must be pointed out that in the majority of these cases the time that has elapsed since treatment is less than three years, and an opportunity for recurrence is therefore still present.

Implantation was used in 4 cases. In 3 primary healing was obtained, but the remaining case was so advanced that treatment had to be considered palliative. In 2 of these 4 cases, however, it was found necessary to complete the full treatment with the radium applicator.

The inguinal lymph-node areas were treated as follows: 21 cases by teleradium (1 gm. unit); 2 cases by bilateral block dissection; and 5 cases received no treatment at all. Of the 21 cases in the first group initial clinical freedom from metastasis was observed in 18 instances. Of these, 3 showed recurrences (2 bilaterally) after periods of four years, four months, twenty-one months, and fourteen months. Of these 3 patients with recurrence, 2 responded to further treatment (1 with teleradium and 1 with x-ray therapy) and remained well.

Of the 2 patients treated by block dissection, 1 remained free from recurrence for seven months and died of intercurrent disease. The other has remained free from recurrence for eight years and nine months, but is now dying of adenocarcinoma of the rectum.

The 5 patients in whom the inguinal regions were not treated all remained free from metastasis. Two died of intercurrent disease six years and one month,

and thirteen months after the treatment of the penis. One patient is untraced after four years of observation, and the remaining 2 patients are alive and well after five and one-half years and three and one-half years, respectively. JOHN A. LOEF, M.D.

GENITAL ORGANS

Lacal, F.: Hormone Treatment of Hypertrophy of the Prostate (Hormonoterapia del adenoma prostático). *Rev. méd. d. Rosario*, 1940, 30: 1082.

After a lengthy summary of what has hitherto been learned about the embryology, physiology, and pathology of the prostate, Lacal reports the results of treatment with testosterone propionate of 18 patients with prostatic symptoms. In mild prostatism and incomplete retention without distention, there was quick and outspoken improvement. In incomplete retention with distention the results were inconstant. The treatment proved ineffective in acute complete retention and sometimes in chronic complete retention. It improved the patients' general condition. Lacal recommends intensive continued treatment, starting with massive doses. For prolonged treatment, the proper maintenance dose should be established. HEINRICH LAMM, M.D.

Thyssen, E.: The Importance of Transurethral Resection of Cancer of the Prostatic Gland Performed According to McCarthy (Ueber die Bedeutung der transurethralen Resektion des Prostatacarcinoms nach Carthy). *Ugesk. f. Læger*, 1940, p. 175.

Of 200 patients in whom a transurethral resection according to McCarthy was performed during the period from 1934 to 1938, 23 had a cancer of the prostatic gland. The author discusses the location, symptoms, diagnosis, and therapy of malignancy of the prostate and charts his results of operations.

Only in very few cases was a cancer of the prostatic gland suspected on the basis of the subjective complaints but in 16 instances the rectal examination justified the suspicion of malignancy, and in all 16 the diagnosis was corroborated by the operative findings. All of the operations were performed under spinal anesthesia, and as much tissue as possible was removed from all three prostatic lobes. The operation was followed by catheterization and irrigation of the bladder, and in addition postoperative x-ray treatment was instituted, the fractional method being used. The total dose distributed over two areas was 3,000 roentgens; sometimes this was repeated.

A very frequent sequel of the operation for cancer of the prostatic gland is the inability of the patient to empty his bladder completely. This complication is usually absent after operations performed for hypertrophy of the prostatic gland. In 60 per cent residual urine was found, which averaged from 100 to 300 c.cm.

Malignancy of the prostatic gland belongs to the group of slowly growing carcinomas which only rarely form metastases. A checkup in 1938 disclosed that of 23 patients only 6 were still alive. In 11 cases a recurrence of the malignancy or a urinary disease were given as the cause of death. As a rule the patients were dead one year after the operation. Of 6 patients still alive April 1938, 3 succumbed to recurrences before February 1939. Of the 3 remaining patients, 1 was suffering from a very painful fistula of the urinary bladder and had numerous metastases in the osseous system. The second patient had to be operated on the second time, while the third was apparently cured.

According to the author's statistics, the curative effect of transurethral resection of the prostatic gland for carcinoma is minimal. Therefore this method should be employed only if a perineal prostatectomy cannot be performed.

(HAAGEN). JOSEPH K. NARAT, M.D.

MISCELLANEOUS

Rammelkamp, C. H., and Stoneburner, L. T., III.: Sulfathiazole; A Clinical and *In Vitro* Study of Its Use in Infections of the Urinary Tract. *New England J. Med.*, 1941, 224: 45.

Sulfathiazole therapy for urinary-tract infections due to escherichia coli and proteus vulgaris has given encouraging results. In this clinical study it has been demonstrated that usually the urine not only becomes sterile and free of leucocytes, but also exhibits definite bacteriostatic and bactericidal action against twenty strains of escherichia coli, three strains of proteus vulgaris, and two strains of staphylococcus aureus.

This bacteriostatic and bactericidal action of sulfathiazole was demonstrated in urine containing between 32 and 456 mgm. of free sulfathiazole per 100 c.cm. A favorable response was obtained in 3 patients with a concentration of less than 50 mgm. per 100 c.cm. It appears from these clinical studies, and also from studies *in vitro*, that a concentration of between 50 and 200 mgm. per 100 c.cm. of free sulfathiazole is sufficient to sterilize the urine. It is necessary to give from 2 to 4 gm. of sulfathiazole in divided doses daily to obtain such concentrations. Restriction of fluid is not necessary. In severe infections, especially those associated with stasis of the urine, a concentration of sulfathiazole between 200 and 450 mgm. is needed. This amount of the drug may be placed in the urine by giving from 4 to 6 gm. in divided doses daily.

No severe toxic manifestations were encountered in these cases. Nausea and vomiting occurred in 2 cases, and there were febrile reactions in 3, 1 accompanied by a cutaneous eruption. The bloods and urines were closely watched, but no evidence of toxic effects was noted.

It is interesting that complicating factors, such as diabetes mellitus, prostatic obstruction, pyonephrosis, and nausea and vomiting, were present in the patients who were not promptly cured. Close analysis shows that some improvement took place under drug

therapy, and this treatment seems valuable even in these cases.

In vitro studies on the action of the various sulfonamide compounds in concentrations of 10 mgm. per 100 c.cm., showed that sulfathiazole had the most marked bacteriostatic and bactericidal action. Several experiments with higher concentrations of the drugs showed sulfathiazole to be more effective, even at these concentrations.

In conclusion, the authors state that sulfathiazole was used in the treatment of 25 cases of infection of the urinary tract, and it was shown to be effective against escherichia coli, proteus vulgaris, and staphylococcus aureus infections.

The urine of patients receiving sulfathiazole exhibited marked bactericidal and bacteriostatic action *in vitro*. Comparative studies of the action of sulfathiazole, sulfamethylthiazole, sulfapyridine, and sulfanilamide in urine containing 10 mgm. per 100 c.cm., showed that sulfathiazole is the most effective bactericidal and bacteriostatic agent against escherichia coli, aerobacter aerogenes, proteus vulgaris, and staphylococcus aureus infections.

JOHN A. LOEF, M.D.

Jensen, A. T.: On Concrements from the Urinary Tract. *Acta chirurg. Scand.*, 1940, 84: 207.

Eighty-four fresh concrements from the urinary tract have been examined by the x-ray powder method and in part by chemical and microscopical methods. It is shown that the powder method is superior to other methods when the unequivocal identification of concrement substances is desired, and that the current somewhat vague terms for different concrement substances are amenable to exact definition by the aid of the powder method.

The following substances were found in the surface layer of the concrements:

$(COO)_2Ca$, $2H_2O$ frequently accompanied by colloidal apatite	40 cases
$(COO)_2Ca$, H_2O frequently accompanied by colloidal apatite	13 cases
$MgNH_4PO_4$, $6H_2O$, colloidal apatite and mixtures of the two	23 cases
Uric acid	6 cases
$CaHPO_4$, $2H_2O$	1 case
B-$Ca_3(PO_4)_2$ and a trace of Ca-oxalate	1 case

Calcium oxalate monohydrate is found considerably less frequently in concrements than is calcium oxalate dihydrate. On the experimental evidence is based the claim that calcium oxalate is always deposited as dihydrate; monohydrate is a product of transformation. With this as a starting point the conditions for the formation of oxalate stones is discussed briefly. "Calcium phosphate" as a concrement substance means (apart from rare cases discussed in the paper) colloidal apatite in "alkaline" infection stones, in which it is accompanied by struvite ($MgNH_4PO_4$, $6H_2O$), as well as in stones from sterile urine in which it accompanies calcium oxalate. Calcium carbonate in "alkaline" stones is not found as calcite or aragonite, but is probably adsorptively bound by colloidal apatite.

JOHN A. LOEF, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Odelberg-Johnson, G.: Tuberculous Bone Foci (Tuberkuloese Knochenherde). *Nord. Med.*, 1940, p. 1084.

Tuberculous bone lesions develop from the breaking down of older foci of the lung or lymph nodes by way of the blood stream, and according to Wallgreen and Lindblom, especially during the first three years after the primary infection. A bacterial embolus reaches the artery of the marrow. A slight trauma, according to Krause, favors the development of the focus. The damaged bone marrow is replaced by tuberculous granulation tissue. The bony trabeculæ become necrotic through injury to the blood vessels or are destroyed by the granulation tissue, and bony cavities filled with caseous pus and granulation tissue are formed. When a larger endartery is obliterated a large area of bone necrosis will result and gradually become demarcated as a large tuberculous sequestrum. The focus has a definite tendency toward demarcation.

The location of the focus in the skeleton may result in the following complications: (1) breaking through into a joint with joint inflammation; (2) breaking down of important function of the skeletal part involved, especially in the spine; and (3) formation of abscesses and fistulas with threatened secondary infection. Tuberculous foci may arise in any part of the bony skeleton, especially in short, spongy bone rich in blood vessels, as in the foot, in which the os calcis is especially susceptible. Even in the patella isolated foci may develop, in children as well as in adults. Complications of these foci are their breaking through into a joint or fistula formation. The treatment consists in radical removal of the focus with retention of the wall of the cavity. In the pelvis there is frequent involvement of the acetabulum with danger of breaking through into the hip joint; foci may develop in the pubis, sacrum, or in the ilium. In the ribs a tuberculous focus may develop near the transition to the cartilage in the posterior part—even in small children; it is a cystlike spina ventosa simulating foci extending to the head of the rib.

The bodies of the vertebræ offer many foci of tuberculosis; they are frequently involved multiply. Frequently two foci are found in adjacent bodies, on each side of the intervertebral disc—a focus. Frequently large necrotic cavities develop as is shown during autopsy. Clinical symptoms may not develop until the intervertebral disc is damaged or until a body collapses due to caries. In the flat bones with little spongiosa the foci are rarer. In the skull fistulas may develop through the scalp by simultaneous involvement of both layers. In the lower jaw foci may lead to spontaneous fracture of the malar bone and especially in little children, as a result of small focal abscesses, fistulas may develop which may leave a typical retracted scar at the edge of the orbit. In the long bones the diaphysis and the metaphysis are involved especially during childhood (when the epiphyseal cartilage is involved growth may be interfered with). In the short diaphyses the metacarpal and metatarsal bones are most often involved; in the former the spina dentosa develops by periosteal proliferation. In older children and adults diaphyseal tuberculosis is relatively rare. In general tuberculous skeletal foci may occur multiply and new foci may develop after a long period of quiescence. As the tuberculous bone focus is only a part of the primary tuberculous infection the prognosis depends on the latter. Acute miliary tuberculosis frequently is the end-result of such cases and urogenital tuberculosis a frequent and serious complication. The tuberculous involvement of the lung is frequently under control by fibrosis. A serious complication in all tuberculous involvement of bone is the secondary infection and the formation of abscesses and fistulas with the danger of sepsis and amyloidosis. The treatment must primarily be directed toward the general infection.

Extensive operations should be avoided. Local treatment in the form of operation—in which the focus must be radically extirpated—should consist of the following: (1) primary suture of operative wounds and (2) the employment of orthopedic measures, long immobilization, and no weight-bearing. Healing with some loss of function may be expected in many cases. It is a mistake to attempt major operations and orthopedic maneuvers in the presence of a poor general condition or in the presence of progression of the disease, and it is likewise wrong to postpone a clearly indicated procedure unnecessarily. The general condition of the patient should be improved first with dietetic and hygienic measures such as heliotherapy, after which the general resistance increases and even a bony focus may recede.

In the treatment of all cases of tuberculous bone disease the following three points must be observed (Erlacher): (1) the treatment of the tuberculous infection, the underlying disease; (2) the orthopedic indication, the preservation or the restitution of function of the involved bone; and (3) the economic indication—the cost and time required by the plan of treatment must be in proper relation to the achievable anatomical and functional result.

(Richter). Leo A. Juhnke, M.D.

Kinney, L. C.: Multiple Myeloma. *Radiology*, 1940, 35: 667.

The typical case of multiple myeloma presents a fairly obvious picture, but there are so many variants from the usual, and lesions may be so closely

simulated by other pathological conditions that diagnosis from clinical and laboratory methods may be obscure if not impossible.

The lesions of multiple myeloma are malignant osteolytic tumors arising from cells in the red bone marrow. They have no relation to the osteogenetic cells and hence do not produce bone. By the time the lesions are sufficiently large to give x-ray findings, they are generally multiple in the involved bone and usually occur in several locations. The lesions in the early stage are, as a rule, limited to the bone and often there is no palpable tumor or swelling. Four definite types of myeloma are recognized by the Registry of the American College of Surgeons depending on the predominant type of marrow cell found in the lesion, namely, the plasma-cell, myelocyte, erythroblast, and lymphocyte. However, this classification has no clinical significance. The gross pathology and the clinical course of these four types of the myeloma series are similar and cannot be differentiated except by microscopic study. The plasma-cell myeloma is the type generally found.

As the disease progresses the lesions in any one bone increase in size and number and there is usually an increase in the number of bones involved. There is no evidence that these lesions are metastases; they are probably independent lesions. However, myeloma does metastasize to the soft structures and typical lesions have been found in the liver, spleen, and lymph nodes. Occasionally metastatic glands are found before bone lesions are large enough to be demonstrable.

There are no characteristic symptoms of multiple myeloma. Pain may be mild until some minor injury precipitates a fracture or crushing of a vertebra, and it may be shifting and intermittent. It may be insignificant until after the bone lesions are well advanced, or it may be intense and severe before the lesions can be shown on the roentgenogram. The presenting symptoms may in no way point to the disease.

The presence of Bence-Jones bodies in the urine occurs in from 50 to 65 per cent of myeloma cases but it is not pathognomonic. Bence-Jones bodies are formed in the bone marrow and may appear in the urine in any disease of the marrow including metastatic carcinoma. The presence of Bence-Jones bodies eliminates hyperthyroidism as proteinuria is not seen in this disease. The absence of Bence-Jones bodies is not significant because they occur only intermittently in the early stages of the disease and may be entirely absent in from 30 to 50 per cent of the cases. A more constant finding in the urine is the evidence of nephritis which occurs in about 70 per cent of the cases.

The blood picture is not characteristic, although there is usually a progressive anemia. There may be an increase in the serum calcium but the serum phosphorus remains normal or increased.

The roentgen findings depend on the stage of the disease in which the examination is made. Usually the patient appears several months after the onset and there are diffuse multiple bone lesions. The bones most frequently involved are the spine, ribs, skull, and pelvis. The most characteristic findings are small, multiple, clean-cut areas of bone destruction with the appearance of having been punched out of otherwise normal bone. The lesion is purely osteolytic and does not produce a bone reaction or sclerosis. While there is union of pathological fracture, there is no evidence of new bone on the roentgen films. There is no thickening of the tables of the skull and there are not the large areas of bone destruction which may be seen in the Schueller-Christian syndrome. There is no bone reaction in the surrounding skull as is seen in carcinoma and syphilis and the lesions do not tend to be irregular and infiltrating as in metastasis. In the spine, there may be extensive destruction of the vertebral bodies by osteolytic lesions presenting no x-ray evidence until the cortex is involved, with collapse of one or more bodies. In the ribs the most frequent finding is diffuse mottling and demineralization with multiple spontaneous fractures in areas of cystlike expansion. Lesions may perforate the ribs and give soft-structure tumors; spontaneous fractures of the ribs may cause localized subpleural hematoma and develop pleural effusion or empyema. Large soft structure tumors may arise from the posterior surface of the sternum or from the vertebræ, and give the appearance of primary mediastinal tumors. There is no metastasis to the lung fields, which factor is of importance in diagnosis.

The osteolytic type of metastatic carcinoma closely simulates multiple myeloma and it may be impossible to differentiate between the two on the roentgenogram. Bence-Jones protein may be found in either, and the blood picture may be identical in both. However, the typical small myeloma lesions occurring in the skull can usually be distinguished from the larger, more diffuse, moth-eaten areas of metastasis. The reactions of osteitis and sclerosis, frequently seen in and around metastatic lesions, are never seen in myeloma. Multiple myeloma lesions are purely osteolytic. Osteoblastic changes are evidence of metastases.

Paget's disease, in which the bone absorption is accompanied by simultaneous bone production and alteration and rearrangement of architecture, should not be a difficult differential problem. It is never a purely osteolytic lesion. The lesions of myeloma are never accompanied by the thickening of the tables of the skull which is characteristic of Paget's disease.

Four case histories are given which demonstrate the multiplicity and varied nature of the presenting symptoms and general course of the disease.

F. Harold Downing, M.D.

Kaplan, E. B.: Surgical Approach to the Proximal End of the Radius and Its Use in Fractures of the Head and Neck of the Radius. *J. Bone & Joint Surg.*, 1941, 23: 86.

Based on an anatomical study of the various branches of the radial nerve in the region of the el-

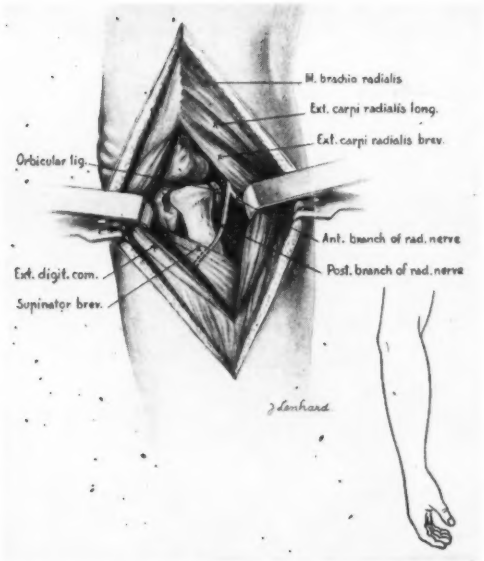


Fig. 1. Artist's drawing showing the exposure of the head and neck of the radius with the anterior and posterior branch of the radial nerve. The cut orbicular ligament can be seen between the nerve and the radial head. The muscle mass retracted laterally consists of the brachioradialis and extensores carpi radialis longus and brevis. The medial mass contains the extensor digitorum communis. The oblique fibers seen in the depth of the wound represent the supinator radii brevis. Note the relation of the posterior branch to the head and neck of the radius, the forearm being in supination, as shown in the insert.

bow, the following recommendation is made by the author for surgical approach to the head of the radius. The patient is placed prone on the table with the extremity on an arm-board and the forearm completely pronated. The incision is made over the lateral aspect of the elbow, starting directly over the epicondylic ridge 1½ in. above the epicondyle and extended down for about 2 in. below the radiohumeral joint. The incision is carried down to the bone between the brachioradialis and the radiocarpal extensors laterally and the extensor digitorum communis medially. The supinator radii brevis is identified in the depth of the wound and retracted, after which the radial head and neck are exposed. By use of this incision, the author has secured adequate exposure without fear of nerve damage.

DANIEL H. LEVINTHAL, M.D.

Heine, J.: Posterior Prolapse of the Intervertebral Discs (Ueber den hinteren Bandscheibenprolaps). *Chirurg*, 1940, 12: 611.

The author reports a case of a so-called posterior prolapse of an intervertebral disc. The tenth thoracic disc was prolapsed, ossified, located extradurally, and firmly adherent to the dura. A retraction in the horizontal direction was present. In the craniocaudal direction the disc was prolapsed 2 cm. and in the lateral direction 1 cm.; it was protruding 1 cm. into the spinal canal. The spinous process of the eleventh thoracic vertebra was present. The intervertebral discs of the entire spinal column were degenerated, especially the tenth thoracic disc which showed a partial calcification in the roentgenograms.

According to the literature, in some cases the prolapse of the intervertebral disc, diagnosed clinically, was not found at the operation because either it was not localized correctly or it slipped back into its normal position. Such a spontaneous reduction is possible only if the disc is not calcified or ossified and if it has not broken completely through the posterior longitudinal ligament.

The author made studies on cadavers in order to discover the mechanical conditions under which a prolapse originates. Before the operation an attempt should be made to place the prolapsed disc into its normal position. The body posture in which the symptoms are most or least intensive should be ascertained. Myelograms may furnish valuable information. (BODE). JOSEPH K. NARAT, M.D.

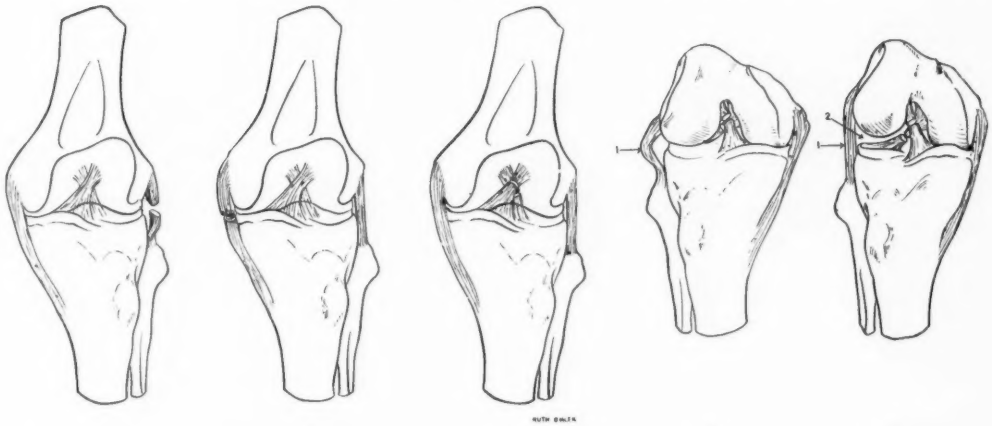
Brantigan, O. C., and Voshell, A. F.: The Mechanics of the Ligaments and Menisci of the Knee Joint. *J. Bone & Joint Surg.*, 1941, 23: 44.

A comprehensive review of the literature reveals no unanimity of opinion concerning the function of the knee-joint ligaments, and often equivocal statements are made.

In the course of a study of approximately 100 knee joints, observations have been made which seem to offer some clarification of the functional rôle of the ligaments of the knee joint, and tend to settle some of the moot points mentioned.

The joints were dissected in every conceivable manner with special reference to the capsule and ligaments. Tests of function and motion were made in fresh and preserved joints stripped of all parts except the ligaments. Individual ligaments and combinations of ligaments were cut, and the function of the ligaments and motion of these joints were studied. Joints were split in different planes and the bone configuration changed to bring into view the ligaments and their activities. The joint cavity was injected, and frozen cross sections were made. The result of cutting individual ligaments and combinations of ligaments was studied in fresh intact knee joints. Microscopic studies were made of the tibial collateral ligament and medial meniscus.

By a fresh joint is meant one recently amputated and studied without having been preserved. To avoid repetition, the statement "fresh intact joint" will mean a fresh joint without anything removed, not even the skin. A "stripped joint" will indicate a joint with all structures removed down to and including the capsule, but with the ligaments and menisci of the knee joint intact. Lateral motion will mean abduction or adduction of the tibia on the



a b c d e

FIG. 1. *a, b, c.* A stripped joint in extension; various ligaments cut. *a.* There is no abnormal lateral motion when only the fibular collateral ligament is cut. *b.* There is no abnormal lateral motion when only the tibial collateral ligament is cut. *c.* With the joint extended there is no abnormal lateral motion when both cruciate ligaments are cut and both collateral ligaments are intact (see *d* and *e*). *d, e.* A stripped joint in flexion with both cruciate ligaments cut and both collateral ligaments and menisci intact. *d.* There is relaxation of the fibular collateral ligament (*1*). *e.* There is an abnormal amount of lateral motion present (*2*). (Compare with Fig. *c* where there is no relaxation of the fibular collateral ligament in extension and no abnormal lateral motion.

femur, and rotation will mean pronation or supination of the tibia on the femur.

The following statements are generally accepted without controversy:

Both collateral ligaments are taut in complete extension. The cruciate ligaments by twisting on themselves prevent abnormal medial rotation of the tibia on the femur. In the beginning of flexion the femoral condyles roll on the tibial condyles (certainly the lateral femoral condyle rolls on the lateral tibial condyle, but whether the medial femoral condyle rolls at all is under investigation), and after a certain degree of flexion the femoral condyles glide at one point on the tibial condyles. There is a small amount of lateral motion present in the normal knee joint. A certain amount of rotation is normally present in the flexed position. There is lateral rotation of the femur on the tibia during the first few degrees of flexion. The posterior aspect of the capsule and the oblique popliteal ligament aid in preventing hyperextension. The fibular collateral ligament is relaxed during flexion.

All opinions agree that muscular, tendinous, and fascial structures about the knee are important stabilizers and that they add great strength to the joint.

It is generally accepted that the tibial collateral ligament is intimately attached to the medial meniscus by fibrous tissue. From the study of the present series of joints, it seems evident that there is no strong fibrous tissue connecting these two structures. To verify this, further investigation is being carried on.

Motion of the menisci gives good evidence that the medial femoral condyle acts more easily as the axis of rotation of the knee joint. The backward or forward motion of the menisci is controlled by the movement of the femoral condyles. In moving from extension to flexion the lateral meniscus moves backward a considerable distance, which indicates the rolling backward of the lateral femoral condyle and which corresponds to the lateral rotation of the femur. The medial meniscus moves backward only very slightly.

It is evident from its attachments and position that the anterior cruciate ligament prevents forward gliding of the tibia on the femur, while backward gliding is prevented by the posterior cruciate ligament. However, in hyperextension both collateral ligaments are tight and, therefore, forcing the tibia and femur tightly together will reduce such motion to a minimum. In determining the effect of the tibial collateral ligament on this function, its attachment must be carefully considered. If it were firmly attached to the whole adjacent portion of the tibia, it would prevent forward and backward motion of the tibia on the medial side, but it is not so attached. Its posterior attachment, however, limits posterior gliding on the medial side while in complete extension, though its posterior portion is relaxed in flexion. The fibular collateral ligament cannot possibly exert any effect in flexion because it is relaxed. Clinically, anterior and posterior motion can always be demonstrated under the relaxation of anesthesia if either the anterior or posterior cruciate ligament is ruptured.

That some portion of the tibial collateral ligament is taut in all phases of extension and flexion is evident from the fact that abnormal rotation of the joint is prominent when this ligament is cut.

It is evident that both collateral ligaments, both cruciate ligaments, and the capsule are important in maintaining the lateral stability of the joint. Clinically, collateral ligament injuries have associated cruciate ligament injuries and there may or may not be menisci injuries. One has only to consider the well established fact that a normally functioning knee usually results when one or both menisci are removed at operation to realize the small part that the menisci play in lateral stability.

The most relaxed position of the joint capsule is from 15 to 30 degrees of flexion because all the joints assumed this position when distended by the injection of plaster. In order to have the joint in the extended position, it had to be held so until the plaster hardened.

In discussing the advisability of repairing the anterior cruciate ligament only or the tibial collateral ligament only when both are ruptured, it is probably safe to state that both should be repaired. In the knee joint there is a very close interrelationship among the functions of the collateral and cruciate ligaments, and the capsule. It is hardly possible to give one or more separate and definite functions to any one ligament. When the capsule is incised and sutured, it is intentionally or unintentionally tightened.

If either the tibial collateral ligament or the anterior cruciate ligament is repaired, when both are ruptured, then there is restored to normal all but one of the five important stabilizing structures of the knee joint (disregarding muscular support). Therefore, the repair of either the tibial collateral or the anterior cruciate ligament gives a satisfactorily functioning knee joint. The close interrelationship of the ligaments is the important factor in restoring stability, and not the greater importance of one ligament over the other.

ROBERT P. MONTGOMERY, M.D.

FRACTURES AND DISLOCATIONS

Vázquez Rolfi, D.: Recurring Dislocation of the Shoulder. Operation of Heymanovitch-Nicola. Modification of his Technique (Luxación recidivante del hombro. Operación de Heymanovitch-Nicola. Modificación de su técnica). *Bol. Soc. de cirug. de Rosario*, 1940, 7: 455.

The numerous surgical procedures recommended for the treatment of recurrent dislocation of the shoulder joint are an indication of the lack of satisfactory methods in the treatment of this condition. In recent years Nicola introduced a surgical treatment for this condition which is highly successful. The author's report is based on this procedure and its modifications.

First he describes the pathological anatomy of recurrent dislocation of the shoulder joint:

A. Lesions of the capsular, ligamentous, and muscular structures
   1. Partial or total distention of the articular capsule
   2. Thickening, thinning, tearing, openings, and diverticula in the capsular covering
   3. Tearing away of the capsular insertion at the glenoid
   4. Distention, distortion, elongation, and rupture of the muscles, especially the subscapular muscles and a large part of the biceps

B. Lesions which involve the osseous system of the joint
   1. Alterations in the articular surfaces, such as atrophy, shallowness, or widening of the glenoid cavity or alterations in its borders
   2. A bare smooth area on the posterior surface of the head of the humerus, which is congenital in origin and frequently bilateral
   3. Deformity in the head of the humerus due to abnormal angulation with the diaphysis (about 90 degrees) (hatchet-form humerus)
   4. Alterations of the articular cartilage both of the humerus and the glenoid cavity (erosions, irregularities, and destruction).

A knowledge of the pathological anatomy is necessary for the choice of a proper therapeutic method. A common cause of recurring dislocations is improper care of the first occurrence of the dislocation by too early mobilization and massage which interferes with proper cicatrization and firm healing and consequently leaves an unstable joint. The reduced dislocation should be immobilized in a plaster cast for at least fifteen days to allow for proper healing.

Surgical treatment of recurrent dislocations. The author reviews the literature on the various surgical treatments and classifies them as follows: (1) procedures to modify the articular capsule; (2) intervention on the articular skeleton; (3) work on the musculotendinous parts of the shoulder joint. The latter procedures include attempts to (a) fix the head of the humerus by fascia lata strips in a bone tunnel, (b) fix the head of the humerus by strips of muscle tissue, and (c) fix the humerus by tendoplastic operations. The value of the latter is that a living tendon structure acts as the fixing agent.

The significance of the biceps tendon is indicated by the report of Kolsoff who found a ruptured biceps tendon in 7 cases of recurring luxation of the shoulder joint. The author credits Heymanovich, Nicola, and Galeazzi with establishing the significance of the biceps tendon in curing this condition. The basis of their procedures is the fixing of the biceps tendon in a tunnel made in the epiphysis of the humerus. Heymanovich, in 1927, was the first to use the biceps in this manner. Independently Nicola, in 1929, reported a similar method which by 1935 had resulted in 32 cures without recurrence. Nicola's technique is described in detail in the original article and Nicola's original drawings are reproduced. In brief, the technique consists of severing the biceps tendon, making a tunnel in the head of the humerus,

and placing the biceps tendon in this artificially created tunnel, after which the biceps tendon is reunited by suturing, and the shoulder joint is immobilized in a Velpeau bandage for two weeks. Various modifications of this technique have been introduced by Hobart, Roberts, and Burnet.

The author had a series of 22 cases of recurrent luxation of the shoulder joint under observation. Seven of these were treated surgically. The first 2 were treated according to the method of Nicola. Then the author introduced his own modification which avoids severing and resuturing of the biceps tendon (a source of technical difficulty and weakness). He chisels out a tunnel from the upper part of the bicipital groove into the head of the humerus through the cortex down to the spongy bone; then the biceps tendon is placed down in this gutter and covered over with the spongy bone and a layer of the cortex which has been preserved for this purpose. The shoulder is immobilized for four weeks, after which function is gradually resumed with the aid of massage and motion. None of the patients has thus far had a recurrence. One of them plays basketball regularly and indulges in active sports, which at times require violent exertion. Experiments on animals indicate that a tendon so treated is soon encased in fibrous tissue which then becomes ossified so that the tendon is really encased in bone tissue at the end of the reconstructive changes which occur in the area of surgical intervention.

The author presents a series of illustrations which demonstrate his modification of the method of Nicola. JACOB E. KLEIN, M.D.

Hoets, J.: Fracture of the Neck of the Femur; Pros and Cons of Nailing. *Australian & New Zealand J. Surg.*, 1941, 10: 278.

Fractures of the femoral neck are now expected to be followed by good bony union in a large proportion of cases. With whatever means such a fracture is treated—Whitman's plaster, Smith-Petersen nail, or any other—the essential factor necessary for success is good reduction followed by adequate fixation until union occurs. Before any type of fixation is used, reduction must be accurate when shown by roentgenograms made in two planes.

The younger the patient, the more inclined is the author to use the Whitman method. The older the patient and the more debilitated, the greater is the need for nailing. When failure occurs with nailing, which happens in a small percentage of all the patients, the author uses osteotomy.

The author believes that the nail itself in the hip joint is not the cause of aseptic necrosis, arthritis, and non-union. He presents 3 cases to prove his point. NORMAN C. BULLOCK, M.D.

Schmid, P.: Isolated Fracture of the Tibia (Der isolierte Schienbeinbruch). *Arch. f. orthop. Chir.*, 1940, 40: 412.

In isolated fractures of the tibia the fibula may interfere with the reduction and immobilization of the broken fragments, and therefore the question arises whether it is not advisable to fracture the fibula artificially in certain cases. Between 1926 and 1939, 177 patients with isolated fractures of the tibia were admitted to the Vienna Emergency Hospital. Thirty-eight had compound fractures and were therefore excluded from the consideration. Others had another disease which exerted an unfavorable influence on the healing of the fracture. The author charted the remaining 96 cases in regard to the diagnosis, therapy, clinical course, duration of the healing process, and the ultimate result. He included in his material 10 cases in which an osteotomy or an osteoclasis of the non-traumatized fibula had been performed. In not less than 36 per cent of the cases the age of the patients was under twenty years. The entire material is divided into 3 groups: torsion fractures, 55 cases; transverse fractures, 31 cases; and flexion fractures, 14 cases. The cases included both direct and indirect fractures. Severe dislocations were absent in the majority of the cases because of the obstacle formed by the fibula. Most of the displacements were corrected with Boehler's traction apparatus. The immobilization of isolated fractures of the tibia is rather difficult; a single reduction was sufficient only in 28 per cent; the reduction had to be repeated once in 22 per cent, twice in 10 per cent, 3 times in 5 per cent, and 5 times in 1 per cent. In the majority of cases in which the fibula was severed, the position of the broken tibial fragments was good. In 10 of the 86 cases in which the fibula remained intact malunion resulted. In 1 case delayed union followed. Pseudarthrosis did not occur.

The author concludes from his observations that a primary osteotomy or osteoclasis of the fibula shortens the healing period of the fracture of the tibia because repeated applications of plaster-of-Paris casts become superfluous, and the isolated fracture of the tibia is transformed into a simple fracture of the lower leg which has good healing tendencies. In the majority of cases a prophylactic osteotomy or osteoclasis of the fibula is not necessary because a consolidation of the fragments may be expected in from eight to nine weeks if traction followed by the application of a walking iron is employed. Roentgenograms should be taken at frequent intervals, at least once a week, and the displacement of the fragments noticed in the pictures should be corrected immediately. If after repeated attempts at reduction no good apposition of the fragments can be obtained or a delayed callus formation is noticed, the fibula should be severed. (BODE). JOSEPH K. NARAT, M.D.

ORTHOPEDICS IN GENERAL

Kuperman, A. I.: The Late Results of Gonorrheal Arthritis (Die spaeten Folgen der gonorrhoischen Gelenkentzuendungen). *Urologija*, 1939, 16: 84.

A report is given concerning the findings in 112 cases of gonorrheal arthritis, 76 of which presented

polyarthritis. Sixty-nine and nine-tenths per cent of the patients showed marked improvement in their condition, 13.5 per cent showed some improvement, and 7.2 per cent were discharged with marked disturbances in the involved joints. About 54 per cent of these patients received ambulatory treatment for a period of about one month. It was possible to examine only 36 patients in person; 21 answered questionnaires. These 57 patients, therefore, formed the basis for this study.

Forty-two of them have had their joint conditions from four to eight years; 15 for a period of from two to three years. In 14 the gonorrhea had remained completely untreated up to the time of their admission, in 12 the gonorrheal involvement of the genital organs had remained untreated. A recrudescence of the joint condition coincidental with a gonorrheal reinfection occurred in 12, but was not noticed in 5 others.

The therapy directed to the elimination of the remnants of gonorrheal infection consisted of baths in 3 patients; baths and injections of gonorrheal vaccine in 7; mud baths in 20; and diathermy and massage in 16. In all of the male patients with the exception of 2, in whom the disease was of recent origin, the prostate and seminal vesicles were examined. In 22 of 29 no changes from the normal were found; 5 showed prostatitis and 2 showed vesiculitis. The Bordet-Gengou test was made in 29 of the patients examined. This reaction was negative in 16 patients, positive in 8, weakly positive in 4, and uncertain in 1. The reaction was positive in all patients with prostatitis, vesiculitis, and adnexitis; it was negative in all cases of ankylosis. Of all the patients who presented themselves for follow-up examination 21 (58.3 per cent) were completely cured and 7 (19.4 per cent) complained of pains during changes in weather conditions; it should be noted that to the latter group belonged 2 cases of reinfection.

Taken on the whole, the results of this study reveal that the treatment of old gonorrheal arthritic conditions for the most part show favorable results.

(Rall). Harry A. Salzmann, M.D.

Moore, B. H.: Some Orthopedic Relationships of Neurofibromatosis. *J. Bone & Joint Surg.*, 1941, 23: 109.

The association of neurofibromatosis with skeletal changes that are of interest to the orthopedic surgeon are classified under four headings: scoliosis, abnormalities of growth (usually hypertrophy), changes in bone structure, and congenital pseudarthrosis in children.

Four cases of localized hypertrophy are presented. One of these involved only the third and fourth fingers of the right hand. The other cases showed hypertrophy of a lower extremity and represented gradations in the degree of hypertrophy and involvement of the part.

A palpable tumor was present in the palm of the first patient. At operation the tumor was found to arise from the median nerve and pathological examination showed it to be a neurofibroma of the "Ranken-neuroma" type.

Elongation of the right leg with deformity and hypertrophy of the foot were present in the second patient. Swelling was noted beneath the internal malleolus and at operation this was found to be a tortuous, firm mass that was lying in close proximity to the posterior tibial nerve. Sections of this tumor showed it to be a neurofibroma with slight evidence of endarteritis.

The third patient showed increased leg length and hypertrophy and deformity of the foot. There was considerable roentgenological evidence of bony deformity in the foot. A tortuous, corded tumor could be felt behind the external malleolus and a large portion of this was removed at operation. Pathological examination showed a neurofibroma of a mature type and also considerable endarteritis.

The left tibia of the fourth patient was 6 in. longer than the right. The foot was markedly deformed and dorsiflexed. This patient also had a marked scoliosis of the thoracic spine, with a wedge-shaped vertebra at the apex of the curve, which showed normal epiphyses on only one side of the vertebral body. Amputation of the leg followed a biopsy report of neurofibroma. The posterior tibial nerve in the amputated specimen was thicker than normal and on pathological examination showed a rather plexiform tumor with a tangled mass of mature fibrous tissue. Definite endarteritis was again present.

In addition to the cardinal signs of pigmentation and a plexiform tumor, these 4 proved cases of neurofibromatosis all presented one common feature, localized hypertrophy. There was in each case a definite segmental relationship between the affected nerve and overgrowth. The rapid longitudinal growth of the affected long bones was evident by the preponderance of vertical trabeculæ in these bones, but associated with such evidence of hypertrophy, there was also underdevelopment and malformation of the bones in the foot, which is interpreted as representing uncontrolled bone growth.

Because of a familial history of neurofibromatosis, 3 cases were selected from a series of 8 to show the relationship between pseudarthrosis and neurofibromatosis. The first case has been followed up for more than eleven years and although union of the middle tibial shaft (pseudarthrosis site) occurred eighteen months after an osteotomy, a zone of increased density in the lower third of the tibial shaft was the site of a fracture six and one-half years after this operation, and later resulted in a second pseudarthrosis of the same bone. There was considerable skin pigmentation of this patient, and a definite familial history of von Recklinghausen's disease was given.

A pseudarthrosis in the lower third of both bones of the leg was present in the second case of this group. Repeated operations failed to produce union and amputation was necessary. Pathological ex-

aminations of sections through the posterior tibial nerve showed an increase in fibrous tissue which in only a few nerve bundles had completely replaced the nerve tissue. The general structure was typical of neurofibroma.

The lower third of both bones of the leg was similarly the site of pseudarthrosis in the third patient. The one operation on this patient was unsuccessful and she was fitted with a brace to be worn until adolescence when another attempt to secure union is planned.

Pseudarthrosis and localized hypertrophy represent entirely different types of bone lesions, yet there are similarities. All but 1 of the pseudarthrosis patients and all of the patients with localized hypertrophy showed typical skin pigmentation. There was a similar segmental relationship between the involved nerve and the affected bones in the 1 case of pseudarthrosis that could be studied histologically. Growth of the affected bones in cases with pseudarthrosis proceeds at the normal rate, but the bones show no inclination whatever to heal or produce callus.

The relationship between neurofibromatosis and bone growth and repair appears evident, but the mechanism is not entirely clear. There is, however, the indication that the bone changes studied in these cases are due to a lack of control over ordinary growth processes in bone. This may result in such diverse deformities as hypertrophy or overgrowth, hypotrophy or underdevelopment, distortions of growth, and changes in the constitution of bones as exemplified by their failure to unite after fracture. Furthermore, it is believed that these bone changes are the result of the nerve changes, but with nerve disease, bony deformity may not necessarily be present. Still unanswered is the explanation for the almost uniform evidence of endarteritis that was observed, and its relationship, if any, to the disease picture.

HOMER PHEASANT, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Linton, R. R.: Peripheral Arterial Embolism. *New England J. Med.*, 1941, 224: 189.

The author notes that the successful restoration of the circulation in a limb following peripheral embolism depends chiefly on early and adequate treatment. The most common cause of gangrene following peripheral embolism is the failure to institute adequate treatment before the arteries distal to the embolus have been irreparably damaged. It is rarely the result of poor surgery or inadequate treatment.

Marked peripheral vasoconstriction of the arteries distal to the site of an embolism uniformly occurs very soon after the lodgment of the embolus. In one case it was noted within an hour and a half. The artery proximal to the embolus is not affected to the same degree. It maintains its normal caliber except for a very short zone of constriction adjacent to the embolus. The peripheral vasoconstriction plays an important rôle in the formation of the secondary distal thrombus which nearly always forms after the lodgment of the embolus, if early adequate treatment is not instituted.

This secondary thrombus develops as a result of the extreme degree of vasoconstriction and slowing of the blood stream distal to the site of embolism, since the marked narrowing of the main and collateral arteries causes practically a cessation of the arterial inflow to the extremity. This leads to stagnation of the blood in the involved arteries, which later clots to form the thrombus. Whether thrombosis begins at the most distal portion of the extremity and extends upward, or just distal to the embolus as a result of the irritation to the intima has not been established.

A thrombus may form distal to an embolus as early as nine hours after the occurrence of the embolism. By then it may be so extensive as to prevent the return of the circulation to the extremity, even though the embolus and a considerable portion of the thrombus are removed. Thrombus formation proximal to the embolus does not form so extensively as that distal to the embolus. Even after seventy hours in one case, it was only 3 cm. long. It can readily be removed. The proximal thrombus is less likely to interfere with the collateral circulation than the distal thrombus, because usually it extends only up to but does not occlude the first major arterial branch proximal to the embolus.

The presence of a distal thrombus virtually precludes the return of circulation to the extremity, because it is impossible, even if the main artery is cleared of blood clot, to remove the thrombus from the smaller tributaries of the peripheral arteries. Failures in the treatment of peripheral embolism can in most cases be directly attributed to the formation of a secondary thrombus distal to the embolus.

In summarizing, the author states that restoration of the circulation following peripheral embolism can be brought about by means of early (within six hours) adequate treatment, such as embolectomy or the use of intermittent venous congestion therapy, and the interruption of the sympathetic pathways by novocaine or alcohol paravertebral lumbar injection. In conjunction with these forms of treatment, the intravenous use of heparin should prove of value in preventing the distal secondary arterial thrombosis.

HERBERT F. THURSTON, M.D.

BLOOD; TRANSFUSION

Domanig, E.: On the Technique of Preserving Blood (Zum Technischen der Blutkonservierung). *Zentralbl. f. Chir.*, 1940, p. 1332.

Five years of experience with blood storage and about 100 transfusions of preserved blood have led to the following "nearly perfect technique" of preserving blood. Preservation of blood is successful only when certain factors which influence this preservation are given due consideration. These factors are: the preserving substance, the storage temperature, strict asepsis, and protection of the stored blood against any harmful factors.

The following mixture has proved itself the best preservative: sodium citrate 2.0 gm., glucose 4.0 gm., sodium chloride 0.4 gm., and distilled water 200 c.cm. This mixture has withstood the tests of trial, and is satisfactory for the conservation of 300 c.cm. of blood, the amount which is usually drawn.

The author describes the technique of drawing blood as follows: Braun's transfusion apparatus is used. As a container for the blood, a 500 c.cm. narrow-necked flask is used. The fully filled flask is placed in a labeled pasteboard carton which is immediately placed upright in a refrigerator where it is protected against jarring. A 10 c.cm. tube filled with the blood mixture is placed on the outside of the carton. This sample is used as a control. Especial emphasis is given to three things in the drawing of blood:

a. The use of paraffin in the lining of the inner surfaces of the syringe and flask
b. Filling the flask well into its neck without shaking the contents
c. The continual mixing of small amounts of blood with the preserving solution in order to prevent the formation of coagulum.

In storing the preserved blood, the mixture must be left absolutely undisturbed in a refrigerator at a constant temperature of about 4° Centigrade. In determining the state of the blood two factors must be considered, infection and hemolysis. The less sharp the border between the serum and the packed cells, the greater is the hemolysis. Only marked hemolysis makes the blood unsatisfactory

for transfusion; slight degrees of hemolysis can be disregarded. Since the adoption of this technique, practically no preserved blood has had to be discarded because of infection or hemolysis. The oldest blood used in a transfusion had been stored for six weeks. All other methods used by this writer have resulted in a loss of about 50 per cent of the stored blood. The blood could not be used.

The following is a description of the transfusion: the blood is warmed to not over body temperature after the flask is opened, care being taken not to shake the flask. The blood is forced into the recipient's vein by means of a pressure bulb, through a rubber tubing in which a fine sieve is placed and which leads directly to the vein. The drawing of the blood requires about ten minutes; the transfusion to the recipient requires from eight to ten minutes. Good results were observed in a large number of cases in which the blood was given by drip infusion. (Welcker). Rulon W. Rawson, M.D.

LYMPH GLANDS AND LYMPHATIC VESSELS

Leitner, S. J.: Aspiration Biopsy as an Aid in the Diagnosis of Inflammatory Affections of the Lymph Nodes (Die diagnostische Verwertbarkeit der Lymphdruesenpunktion bei entzuendlichen Lymphknotenaffektionen). *Acta med. Scand.*, 1940, 105: 558.

Leitner studied 21 patients with tuberculosis of the lymph nodes and 18 patients with acute or chronic non-tubercular lymph-node hyperplasia by means of aspiration, and in some of these cases found this method very helpful in making the diagnosis.

After local anesthesia with ½ per cent procaine solution a fairly thick cannula is thrust into the lymph node. Then repeated aspirations are made with a 10 c.cm. syringe. When the aspiration is successful, a small piece of tissue with or without blood is found in the cannula. This tissue is spread on a slide. Leitner stains it according to the May-Gruenwald-Giemsa technique.

A lymph node which is large enough to permit successful aspiration always is pathological. Thus, the author does not know how aspirated material from normal nodes would look. He assumes, however, that typical lymphocytes should dominate the picture. In addition, one finds younger cells from the lymphatic series, such as lymphoblasts, and plasma cells in all their stages.

Leitner summarizes his findings in aspirations of tuberculous lymph nodes as follows:

1. In acutely necrotic lymph-node tuberculosis one will find leucocytes, rarely lymphocytes, and later, epithelioid cells and necrotic tissue. Giant cells are found quite rarely in aspiration smears.

2. In chronic cheesy and calcifying lymph-node tuberculosis the aspiration smear is similar to that of the acute forms; however, there are more lymphocytes, and sometimes they are quite predominant.

3. In chronic, purely productive lymph-node hyperplasia one will find epithelioid cells and lymphocytes. In some cases monotonous lymphatic hyperplasia prevails. In these cases the diagnosis often cannot be made from the aspiration smear alone.

Aspiration biopsy of lymph nodes is of some importance in the diagnosis of Besnier-Boeck-Schaumann's disease (lymphogranulomatosis benigna—Schaumann and reticulo-endotheliosis epithelioidocellularis—Leitner). There is never any necrosis, and one finds a pure epithelioid cell hyperplasia. However, such a picture occasionally occurs also in productive lymph-node tuberculosis; therefore, biopsy by excision should be resorted to in such cases.

In Hodgkin's disease the aspiration biopsy gives very characteristic pictures, often more significant that an excision biopsy, and Leitner affirms the findings of other authors in citing from one case of his. One encounters in these patients a very polymorphous aspiration smear with lymphocytes, eosinophils, neutrophils, plasma cells, and Sternberg cells, in all stages of development.

The differentiation between tuberculous and pyogenous purulent inflammation of the lymph nodes, of course, is easy by means of aspiration smears. The prevailing type of white blood cell, and the morphological or cultural demonstration of the causative bacterium or bacteria establishes the diagnosis.

In glandular fever (Pfeiffer's disease) aspiration biopsy may contribute to the diagnosis, although Leitner's case had been diagnosed clinically and hematologically before aspiration. Leitner concludes, however, from his findings that this disease is of myeloic *and* lymphatic origin, as he believes that the plasma cells found in increased number in the lymph nodes were not carried there by the blood, but were autochthonous. Heinrich Lamm, M.D.

SURGICAL TECHNIQUE

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Axhausen, G.: The Surgical Treatment of Gunshot Wounds of the Face and Maxillary Region (Die chirurgische Behandlung der Kriegsschussverletzungen im Gesichts-Kieferbereich). *Deutsche Zahn-usw. Heilk.*, 1940, 7: 344.

Since the practical elimination of war-time epidemics, the chief function of the physician has become the treatment of wounds. In this regard the conservative attitude, which is of greatest value in the treatment of clean wounds, has given way to the operative treatment of contaminated wounds. While this change has been widely accepted in the field of general surgery, it has not yet received widespread acceptance in surgery of the face and maxillary region. This fact is due, in part, to the failure of complete understanding of the principles of Friedrich, also perhaps to the fact that severe progressive infections of the face were seen less often because of the ample drainage. Nonetheless, severe deformities often remain, if adequate treatment is not applied at the proper time. Thorough understanding and the proper application of Friedrich's principles may eliminate these deformities. The factors involved are: the anatomical form of the wound, the extent of destruction of the wounded tissues, and the stages involved in wound healing. The authors likewise stress the importance of competent medical treatment in the production of good results in wound therapy.

Prevention of bacterial infection, control of that which is present, and increase of the general resistance facilitates the healing of injuries. Wound débridement with the avoidance of unnecessary sutures is likewise an important consideration, particularly the avoidance of tight closures of the wound margins. Dental procedures, when necessary, should be secondary to adequate therapy of the wound itself.

In regard to skeletal injuries approximation with complete immobilization of the fragments suffices until adequate orthopedic treatment can be rendered at a later date when the soft-tissue injury is no longer a pressing problem.

(J. Volkmann). Stanley Robbins, M.D.

Dobson, L., Holman, E., and Cutting, W.: Sulfanilamide in Actinomycosis. *J. Am. M. Ass.*, 1941, 116: 272.

Six previous reports in the literature on sulfanilamide in the treatment of actinomycosis were favorable. The authors added their 3 cases treated with sulfanilamide, in all of which recovery occurred.

In 1 there was involvement of the jaw and the diagnosis of actinomycosis was made on the basis of smear, culture, and tissue sections. Free drainage, potassium iodide, roentgen irradiation, and general supportive therapy were without much benefit. The administration of 1 gm. of sulfanilamide every six hours was followed by marked regression of the lesion, and was stopped after the fifteenth day. There was a recurrence and the drug was given again for twenty-one days with great improvement when it was stopped because of toxic dermatitis. Potassium iodide and roentgen therapy were reinstituted and the lesion healed.

In the second case there was actinomycosis of the right chest wall and right upper lobe of the lung with positive smears. The administration of 6 gm. of sulfanilamide daily, and of sodium iodide in doses up to 4 gm. with supplementary general upbuilding was begun. The smears became negative. The condition improved and the sinus stopped draining although there was little change in the lung fields. Five months later the lung shadows were reduced and the patient seemed well.

The third case was an extensive actinomycosis of the abdominal wall with cystitis (etiology?). The lesion remained stationary after about a month of treatment with sulfanilamide, then regressed completely after the administration of more sulfanilamide and of iodides and roentgen irradiation.

On the basis of the last case the authors believe that the principal effect of the sulfanilamide during the early stages of treatment was on the secondary invaders, and that other factors were important in the cure. However, in view of the serious nature of actinomycosis, sulfanilamide is recommended for inclusion in the plan of treatment, though apparently not singularly effective. Edwin J. Pulaski, M.D.

Caldwell, G. A.: Treatment of Gas Gangrene Experimentally Produced. *J. Bone & Joint Surg.*, 1941, 23: 81.

The author studied the effects on experimentally produced gas gangrene in guinea pigs following:

1. Local implantation of sulfanilamide crystals
2. Intraperitoneal injections of sulfanilamide
3. Implantation of zinc peroxide
4. Roentgen-ray therapy

From these experiments he concludes that the best method is the use of zinc peroxide which prevents the development of gas gangrene in most instances. Local implantation of sulfanilamide seldom controls or prevents the development of gas gangrene. However, the intraperitoneal injection of sulfanilamide after débridement and irrigation of the wound precludes the development of gas gangrene in a high percentage of cases. Roentgen-ray therapy has no effect upon a fulminating infection but does bring some localization of the process when given one or two hours after inoculation, and when the animals survive forty-eight hours or longer.

Daniel H. Levinthal, M.D.

ANESTHESIA

Gillies, J.: Modern Anesthesia. *Edinburgh M. J.*, 1941, 48: 26.

The author reviews the changes that have taken place in the field of anesthesia between 1918 and 1940. These are discussed, for convenience, under the subdivisions of (a) inhalation anesthesia, (b) intravenous anesthesia, and (c) spinal analgesia.

INHALATION ANESTHESIA

Prior to and during the war from 1914 to 1918 chloroform and ether were the main anesthetic agents used. In the main, chloroform has been discarded in favor of ether because of the greater safety and lesser postanesthetic morbidity associated with the latter. However, the position of ether is now being threatened by newer agents less toxic still, such as ethylene, cyclopropane, and divinyl ether. Nevertheless, ether, used to supplement nitrous oxide and oxygen, in which sequence it appears to lose some of its objectionable features, will probably continue in use for some years to come.

Divinyl ether (CH_2: $CH)_2O$ is supplied in liquid form and may be used by dropping it on a mask, by vaporization into the bag of an inhaler, or by drip control into any gas and oxygen machine. It allows rapid induction but is speedily eliminated, so that consciousness is regained almost at once after the administration ceases. It is less irritant to the respiratory mucosa than ethyl ether and produces a fair degree of muscular relaxation.

Ethylene (C_2H_4) is a hydrocarbon gas which has been used extensively in America, and while it has greater potency than nitrous oxide, it is not so effective an agent as cyclopropane, which has an anesthetic value nearly equal to that of ether.

Cyclopropane (C_3M_6), a hydrocarbon gas, acts in a two-fold manner by displacing oxygen in the blood and by virtue of a degree of lipoid solubility which it possesses. Because of its potency, cyclopropane is administered in a high concentration of oxygen, the average mixture being 15 per cent C_3H_6 with 85 per cent O_2. This gas is practically non-irritating to the bronchial mucosa and therefore is easily respired by the patient. Recovery of consciousness is almost immediate because of the rapid elimination of the gas from the tissues—an important factor because patients have enough to do in recovering from a surgical intervention without the additional strain of having to eliminate a toxic anesthetic agent over a period of forty-eight hours or more. Cyclopropane is expensive to buy, but reasonably cheap to administer. Cyclopropane, like ether, is inflammable and in certain proportions with oxygen is explosive, so that the usual precautions with regard to cauteries or diathermy apparatus must be taken. Finally, it may be stated confidently that this gas, administered in a closed circuit apparatus, is suitable for patients of any age, from the infant of a few weeks undergoing an operation for congenital pyloric stenosis to the septuagenarian undergoing nailing of a fractured neck of the femur. Its greatest value has been best demonstrated in endothoracic operations such as lobectomy and cardio-omentopexy.

Acetylene, in a form called narcylen, has been used in Germany. Its stability is difficult to maintain, however, and it will never be a serious rival to cyclopropane.

Coincident with the search for and the exhibition of the aforementioned less toxic agents, the factor of premedication has assumed an important rôle and there is no doubt that good anesthesia with the agents described is dependent to some extent on the wise use of pre-operative sedation. The fundamental purpose of premedication is to lower the metabolic rate and so render the patient more susceptible to the influence of the anesthetic agent.

However, a word of warning ought to be given regarding premedication. While efficient premedication is an excellent thing, the dosage must not be overdone. Such drugs in relatively high dosage exercise a toxic effect, and the patient may be no better off than if he had been given a toxic drug like chloroform. Additionally, by depression of the respiratory and vasomotor centers, excessive dosage of them may be a material factor in the causation of postoperative pulmonary complications.

Among the advances in the technique of general anesthesia there should be included blind intubation of the larynx, and the development of closed circuit anesthesia or the carbon dioxide absorption technique.

Although the apparatus appears somewhat complicated, the closed circuit technique is the simplest and most foolproof method devised for the administration of nitrous oxide and oxygen with or without supplementary agents such as ether or cyclopropane.

The simplicity of this method and its extreme safety are due to the fact that once the required depth of anesthesia is attained all the potentially dangerous elements (the gas and the ether) are cut out and only oxygen is supplied from the machine. Further advantages are that much less anesthetic is required for satisfactory anesthesia, that the circulating anesthetic vapor is warmer than the continuous cold stream of gas and ether of the semi-open method, and that there is some conservation of water vapor which the patient would lose by exhalation if the circuit were not closed.

INTRAVENOUS ANESTHESIA

Pentothal sodium has been the most successful of such agents. Intravenous anesthesia requires expert judgment, and the occasional anesthetist ought to confine his use of the method to short procedures such as manipulations, reduction of fractures, and opening of abscesses, and then only when gas and oxygen is unavailable or unsuitable. Compared with other agents, this is an expensive anesthetic. Care must be taken not to administer this drug to patients who are undergoing treatment with sulfonamides.

SPINAL ANALGESIA

Hypobaric solutions such as percaine and spinocaine have had a considerable vogue, but after considerable use of such agents one feels that there is less anxiety, less risk to the patient, and a considerable saving in time in the less elaborate method of dissolving procaine crystals (in the form of neocain for choice) in the patient's cerebrospinal fluid and injecting the solution into the subarachnoid space. Very safe and satisfactory analgesia is thus obtained.

For upper abdominal work when spinal anesthesia is chosen, the detrimental effects due to intercostal paralysis can be effectively countered by the simultaneous administration of nitrous oxide and oxygen, or cyclopropane and oxygen sufficient to produce unconsciousness. Better ventilation of the lungs is thus maintained, and this combined method has much to recommend it.

When severe shock is present, spinal-block analgesia should not be used. It must be remembered that spinal block, while giving protection against the shock-producing sensory stimuli from the operation field, also produces paralysis of the sympathetic nerves in the segments involved, and this causes a reduction in the volume of the circulating blood. In a severely shocked patient whose blood pressure is already low the additional fall may lead to a cerebral anemia of such degree as to depress the vital centers beyond the limits compatible with life.

Among the problems which confront the anesthetist is the one of choice of anesthetic and the method of administration for operations in certain regions and for certain surgical conditions. The author makes the following suggestions:

For operations about the head and neck endotracheal anesthesia is essential in order that the surgeon may have free access to the field of operation. In cases of severe head injury when the patient is unconscious no anesthetic is required, but it is a wise precaution to intubate the patient so that in the event that respiration ceases because of increasing intracranial tension, the anesthetist may immediately start rhythmic inflation of the lungs with oxygen.

For operations on the chest wall endotracheal anesthesia with remote control is the best method. Similarly, for endothoracic work such as lobectomy or operations on the heart the endotracheal route should be chosen, but the added refinement of the closed circuit method with controllable intrapulmonary pressure is very desirable.

Abdominal operations require deeper anesthesia than all others. Spinal-block analgesia provides maximum muscular relaxation, and for routine operations in the abdomen this method is probably the best, if the patient is reasonably fit and properly prepared. Alternatively, nitrous oxide and oxygen supplemented with ether may be given. In casualty work, however, the abdominal cases will be chiefly patients who have sustained penetrating wounds. Such injuries, if viscera are perforated, usually produce a serious degree of shock, and for reasons already stated, spinal block is inadvisable. Additionally, it is a most unwise thing to employ spinal block when there is any question of the bowel being perforated, because of the unopposed action of the parasympathetic nerves causing marked contraction of the bowel and expulsion of the contents into the peritoneal cavity. Light non-toxic inhalational anesthesia with nitrous oxide and oxygen, supplemented if necessary by local infiltration or regional nerve block, is the safest and most suitable choice.

Dislocations, fractures, and associated lacerations of the soft tissues of limbs are best treated under light general anesthesia, but it must be sufficient to allow the surgeon to overcome muscular contraction in his manipulations. Here again there may be marked shock, in which case nitrous oxide and oxygen should be used.

Finally, mention ought to be made of anesthesia for patients suffering from burns. Such patients are generally seriously shocked and show diminished sensibility to pain. The only anesthesia required, if it can be called anesthesia, is light gas and oxygen sleep. Nothing more than that is necessary and anything more, such as ether, is extremely harmful to the patient. SAMUEL H. KLEIN, M.D.

Rapoport, B.: Anesthesia in Orthopedic Surgery. *Anes. & Anal.*, 1941, 20: 19.

Orthopedic surgery presents many anesthetic problems which require individual solution on the part of the anesthetist. In most cases, less relaxation is required which allows the patient to be carried on a lighter plane of anesthesia Certain problems are entailed, however, which present difficulties in both the choice and method of administration of the anesthetic. The use of the x-rays and other electrical apparatus makes the use of ethylene and cyclopropane hazardous, while many other circumstances render the employment of spinal anesthesia impractical.

Although the majority of orthopedic surgeons prefer inhalation to spinal anesthesia, yet if given the proper case, especially when inhalation anesthetic is either contraindicated or impractical, spinal anesthesia can be of great benefit.

The dosage required for spinal anesthesia in orthopedic surgery is much smaller and rarely need exceed 100 mgm. of procaine; 50 mgm. was found to be sufficient for a foot operation, 75 mgm. for one on the knee or leg, and 100 mgm. for one on the hip or pelvic bones. In cases in which the operation is to last for a longer period than procaine or neocaine would allow, pontocaine or nupercaine (1:1500) in proportionate doses may be substituted. In some cases of manipulation and stretching for sacro-iliac conditions, as little as 50 mgm. has been given, which resulted in complete relaxation for the required procedure.

For epidural anesthesia from 35 to 50 c.cm. of a 2 per cent solution of procaine was introduced into the epidural space. Since this space has no direct

connection with the brain and spinal cord, it was hoped that frequent reactions associated with spinal anesthesia would be eliminated. Reactions, however, were found to be more severe and seemingly of the circulatory type from absorption of the drug into the circulation.

Local and regional anesthesia have a wide field of usefulness and a large number of minor operations as well as certain fractures and dislocations can be successfully handled under local anesthesia. Also caudal block for low back conditions and blocking of the sciatic nerve proves effective in many cases. Brachial plexus block is valuable for operation on the upper extremities. The latter does not, however, give a constant and uniform anesthesia even in the hands of the experienced.

Chloroform is not advised for inhalation anesthesia as it is believed that cyclopropane can take its place more effectively and with greater safety.

Ethyl chloride is still being used by many for induction in children and in minor surgery. It is considered a dangerous drug because of its likelihood of causing laryngeal spasm. The patients sometimes stop breathing after a very short induction and this may be followed by cardiac arrest.

Divinyl ether (vinethene), given by the drop method, can be employed only in short operations. It has a degenerative effect on the liver and is only suited to short operations in which a quick and smooth induction with good relaxation is desired.

Ethylene can be more effectively replaced by cyclopropane. Since both are equally inflammable and explosive, there is nothing to be gained from the use of the former when cyclopropane is available.

Nitrous oxide, having a potency of only 25 per cent as compared with the other two anesthetics, is more often employed for short and minor operations. Anything more extensive requires either a basic anesthesia such as avertin, or supplementary anesthesia of ether or cyclopropane. Since it is not explosive, it can be used with either the x-rays, cautery, or other electrical apparatus.

Ether is the anesthetic which is the easiest and safest to administer. With 100 per cent potency, it is a valuable supplement to all other weaker anesthetics and basic anesthesia agents. The toxicity of ether is much reduced when it is used in combination with other drugs. When administered alone, in large amounts, and for a long period of time, it has a marked irritant, depressive, and toxic effect upon the respiratory and gastro-intestinal tracts. It also causes liver and kidney damage. The most important contraindications are disturbances and pathological conditions within the respiratory organs.

Cyclopropane, a very effective and potent anesthetic with practically no toxic effect upon the blood chemistry or vital organs, has only one drawback in that it is inflammable and explosive. It is especially indicated in conditions in which ether is to be avoided, and is particularly recommended in cases in which the patient needs a high percentage of oxygen, as in anemia, sepsis, diabetes, general debility, and in chest, liver, kidney, and glandular conditions. Its smooth and quick induction, with its accompaniment of complete relaxation, renders it of great value for short orthopedic procedures which require good relaxation. It is also good in major orthopedic operations with or without basic anesthesia.

The two agents most commonly used for intravenous anesthesia are evipal sodium and pentothal sodium. Both are barbiturates and their action is equally rapid. Since they are non-volatile substances, they are destroyed in the body. This process takes place so quickly that there is no question of cumulative effects. This type of anesthesia is most suitable for short operations lasting from ten to twenty minutes. The contraindications are cardiovascular and renal diseases, respiratory obstruction, and liver trouble.

Avertin is the most popular agent with orthopedic surgeons for rectal anesthesia. Its employment as a basal anesthetic in doses of from 60 to 80 mgm. per kilogram of body weight greatly facilitates the induction by elimination of laryngeal spasm. The maintenance is smoother and relaxation is obtained with much less of the anesthetic agent and a larger percentage of oxygen. Since it has no deleterious effect on the heart, it is very beneficial in reduced doses on cardiac patients. Since it is eliminated through the liver and kidneys, it should not be given in diseases of these organs. It should not be employed in operations upon the colon or rectum and in diseases of the lower bowel on account of its irritant effect on open mucous membranes. It should also be avoided in long-standing septic conditions and in overwhelming infections; in diabetes, anemia, and marked arteriosclerosis; in debilitated and aged people, and in infants. The two extremes of age do not require basic anesthesia on account of the low metabolic rate of infants and old people, which renders them less resistant to an anesthetic agent, and of which they, therefore, require a less amount.

Evipal sodium used in a 10 per cent solution with a dosage of 0.2 c.cm. per pound of body weight may be administered rectally with a fine catheter. Its only advantage over avertin is that there is a smaller amount of solution injected into the rectum, the amount being one-seventh that of avertin, and it is therefore recommended when there is danger of the solution's being expelled.

The intravenous administration of glucose and saline solution is advised in case of marked bleeding or trauma; it should be done during the operation. Transfusion is to be resorted to when indicated.

In cases in which movement of the chest is greatly impeded by the patient's having to lie on his face, such as in spine fusion operations, Leech's pharyngeal airway is recommended. This airway consists of a bulbous projection made of rubber at the end of an airway tube and so shaped as to fit snugly into the cavity of the pharynx. This gives a clear airway and a closed system for rebreathing without the requirement of keeping a mask over the face.

A statistical report of the types of anesthesia employed at the New York Hospital for Joint Diseases during the year 1938 is also given.

F. HAROLD DOWNING, M.D.

SURGICAL INSTRUMENTS AND APPARATUS

Moraes Barros, N.: A Comparative Study of Silk and Catgut as Materials for Suture and Ligation (Estudo comparativo entre a sêda e o catgut como materiais de ligadura e sutura). *Rev. de cirurg. de S. Paulo*, 1940, 6: 123.

The question of suture material seemed to be settled with the discovery of catgut. Surgeons were so delighted with the fact that it was absorbed that they failed to study its other qualities carefully and paid little attention to those surgeons who still preferred silk, including Kocher in Germany, Halsted in the United States, and Gudin in Brazil.

However, in recent years careful statistics have been collected on the two suture materials, which show that when properly used in aseptic cases silk has certain decided advantages over catgut. The author cites statistics from the literature not for the purpose of discrediting catgut but to justify a greater use of silk.

In every cicatrization there are two phases, an exudative and a proliferative. Experiments on rats in which the stomachs were sutured, some with silk and some with catgut, showed that the exudative phase was prolonged in the cases in which catgut was used and that the establishment of a resistant scar required a longer time than when silk was used. This irritative quality of catgut is largely due to the chemical preservatives used, such as iodine, formalin, and chromic acid.

However, the allergy produced by catgut is more serious than the chemical irritation. Catgut is a foreign protein taken from the intestines of sheep, the most contaminated part of an animal that has a strong tendency to produce allergic reactions in man. Figures are given from various authors in regard to the allergic reactions produced by catgut.

Figures are also given showing a greater percentage of dehiscent wounds when catgut was used than when silk was used, but various factors enter into the causation of dehiscence.

Tests of different makes of catgut are reported and there was found to be considerable difference in the percentage of infections following the use of catgut prepared by different manufacturers. Higher percentages of infection are reported with catgut sutures than with silk.

Silk should not be used in infected wounds if it can be avoided. However, if fine silk is used and as careful a technique as possible is employed, with the avoidance of trauma, silk sutures are not apt to be eliminated. The author believes that silk is the suture material of choice in all non-infected wounds.

AUDREY G. MORGAN, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Gilardoni, A.: Roentgenography in a Millionth of a Second (La radiografia al millionesimo di secondo). *Radiol. med.*, 1940, 27: 944.

A few years ago, the author designed an apparatus for "ultra-short" roentgenographic exposures. A high tension generator charges a condensor and between this condensor and an x-ray tube is inserted a "spinterometer." As soon as the tension in the condensor grows high enough to overcome the explosive distance of the spinterometer, the condensor instantly discharges all of its stored energy on the x-ray tube. The result is an extremely short flash of x-rays, repeating itself automatically in given intervals. The initial tension and the capacity of the condensor are directly proportional, and the current emitted by the tube is indirectly proportional, to the duration of the single flash. With an initial discharge tension of 100 kv., this apparatus produces more than twice the energy generally used by a modern street car, with flashes as short as one-millionth of a second.

The Philips Company of Eindhoven, Netherlands, has recently built a similar apparatus, allowing exposure times of one-millionth of a second by overheating the cathodic spiral of the tube and by employing a condensor of very small capacity.

Gilardoni, however, insists that for medical purposes his apparatus is sufficient and that the new one made by Philips is impractical. The necessity of ultrashort exposures occurs in the roentgenography of moving objects, which otherwise would cause blurs on the picture. However, the speed of human movements generally does not exceed 50 mm. per second, as in the case of a tachycardiac heart; it may be higher in children and in arteriography; it may rise to 100 mm. per second during spasmodic fits. Using the "milligraphy" of Gilardoni, even in such cases the blurrings would amount to only .05 cm., which is practically nil. In the "regmography" (Cignolini) of the lungs these "unavoidable blurrings," according to Gilardoni, would be kept within normal limits.

On the other hand, the minor capacity of the condensor always means a reduction of the x-ray energy left for roentgenography, and, therefore, a shorter distance between object and film. Gilardoni obtained pictures of the duodenum from a distance of 70 cm. and of the normal lungs from 150 cm. The Philips Company mentions that the only picture of a human being was that of a hand, taken "from a very short distance." Perhaps the further development of the Philips apparatus will make it suitable for certain cases of regmography. NELDA CASSUTO.

Hemmingson, H.: Roentgenological Investigations on the Intracranial Subdural Space with a View to Revealing the Presence of Subdural Adhesions. *Acta radiol.*, 1940, 21: 379.

A brief account of the topography of the intracranial subdural space is given, and the origin and significance of subdural adhesions between the brain and the dura in cases of post-traumatic encephalopathy and epilepsy is discussed. Encephalographic procedures have demonstrated occasional air accumulations either wholly or partially in the subdural space after lumbar or cisternal insufflation and various explanations offered for its occurrence by different investigators are given consideration. The presence of subdural air on the encephalogram is not a sign of cerebral atrophy, which is a misinterpretation sometimes found in the literature.

Penfield and Norcross have advanced a method for direct intracranial subdural insufflation which is described in detail. With it, this cavity has been brought within the range of roentgenography, and it is possible to reveal subdural adhesions directly on the roentgenogram. The author has used this method in a number of examinations and presents his findings in normal and pathological cases. A report of 4 cases is appended in which subdural adhesions were visualized in this manner, but the encephalograms gave no definite signs of the presence

Fig. 1.

Fig. 2.

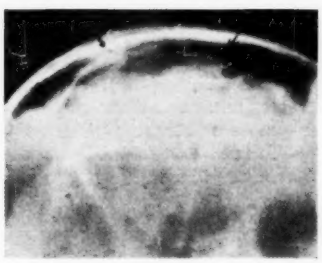


Fig. 3.

Figs. 1 to 3. Filamentous subdural adhesions over the right frontal lobe in Figure 1 and a broad, superficial adhesion over the right frontoparietal region in Figures 2 and 3.

of cerebrodural cicatrices and in 2 of the cases no adhesions could be found through the trephine hole during the Penfield operations. Numerous roentgenograms illustrating the findings are included.

ADOLPH HARTUNG, M.D.

Kirklin, B. R.: Bleeding Lesions of the Gastro-Intestinal Tract and Their Roentgenological Diagnosis. *Am. J. Roentgenol.*, 1941, 45: 171.

Among the many and varied manifestations of disease, Kirklin wrote, few are more definitely indicative of potentially grave organic changes than bleeding from an internal organ, and the concern with which it is regarded, both by the patient and his physician, is fully warranted. When frank bleeding from the alimentary canal has occurred and the clinician has ascertained that the hemorrhage is not of orificial origin, he will try to determine its probable source from the history, physical signs, results of clinical tests, and the subtle and indefinable indexes that he has learned from experience. Often, by his own methods alone, a capable clinician can adjudge the general situation and nature of the lesion with admirable accuracy. However, even in such instances no one realizes more keenly than the clinician himself that his diagnosis is not complete without roentgenological examination to confirm his opinion as to the nature of the lesion and to determine its exact site and size and the presence or absence of complicating factors.

In cases of hemorrhage from the canal the first thought usually is of peptic ulcer. This inference, although it should not be held to the exclusion of others, is logical, for peptic ulcer is known to be a common source of bleeding. Of the two principal varieties of peptic ulcer, the gastric variety is encountered much less often. The fundamental roentgenological sign of gastric ulcer is, of course, its barium-filled crater, the niche. In profile the niche appears usually as a smooth hemispherical prominence, from 0.5 to 2.5 cm. in diameter, projecting beyond the line of the gastric lumen. In the face view, under a thin coating of barium on the mucosa, or after compression of the barium content of the stomach, the niche is manifested as a dense spot in the hazy shadow of the mucosal relief. Benign ulcer is characterized by non-elevation of its margin, accentuation and convergence of the rugæ toward the crater, tenderness of the niche to pressure, and gastrospasm as manifested in curling of the lesser curvature and other distortions of the stomach.

Among bleeding lesions in the upper portion of the canal, duodenal ulcer stands first in frequency of incidence.

Next to peptic ulcer, cancer in some part of the digestive tract, especially the stomach, should be considered as a possible source of hemorrhage, because cancer is relatively common and its early diagnosis is of the highest importance. Ulcerating mucoid cancer, with its deep thrust into the gastric lumen, can hardly escape recognition with the roentgen rays. Infiltrating scirrhous cancer tends to encircle the stomach and produce a funnel-like deformity, and the multiple shallow ulcers on its internal surface, when coated with barium, have the appearance of ground glass. Small ulcerating cancers have often been mistaken for simple ulcers but are characterized by a tumefied border, which, under pressure to thin out the opaque medium, appears as a transradiant halo around the dense, barium-filled crater. Finally to be considered in connection with gastric cancer are the malignant ulcers, which have no tumefied border but are likely to betray their malignancy by the irregularity of their craters and the absence of tenderness and spastic manifestation, or distortion of neighboring rugæ.

Esophageal varices usually are secondary to cirrhosis of the liver. Profuse hematemesis often results from rupture of the distended vessels. Usually the lower portion of the esophagus is affected, and the veins are greatly dilated and nodular. With the roentgen rays the varices are depicted as bulbous shadow defects intruding into the lumen with deep crevices between. The picture strongly resembles that produced by polypoid new growths, but these rarely occur in the esophagus.

Benign intragastric neoplasms comprise myomas, fibromas, adenomas, and mixed varieties of tumors. They seldom attain great size, may be single or multiple, and when few in number tend to become pedunculated. Ulceration is common but usually superficial. Therefore, bleeding is likely to be slight and occult but more or less continuous and sufficient to produce anemia, which is often the principal or sole clinical sign. With the roentgen rays the individual new growths appear as regularly rounded or ovoid transradiant spots in the barium shadow, and the general form of the stomach is not altered. Numerous multiple, closely packed polyadenomas have a characteristic resemblance, both macroscopically and roentgenologically, to convolutions of the brain. Especially to be remembered is the fact that apparently benign tumors of the stomach are often partly malignant.

Although not common, ulcerative gastritis cannot be omitted from consideration. The ulcerations, which are exceedingly numerous and small, can occasionally be discerned in the face view, but in the tangential view they are clearly exhibited as fine, sharp, closely set, uniform serrations on the border of the barium shadow, and the picture is pathognomonic.

Duodenitis, a diffuse inflammation of the bulbar mucosa, with or without local shallow erosions, is met with rather frequently. It may occur in association with frank duodenal ulcer or independently and is a source of hemorrhage that may be severe. Roentgenologically it is marked by irritability and rapidly changing contours of the bulb, and by a coarsely and irregularly reticular mucosal pattern, due probably to puckering of the mucosa by spasm of its muscularis.

Cancer of the duodenum is extremely rare, and when the growth is situated near the bulb the roent-

genologist is likely to attribute the deformity to duodenal ulcer. Cancer in the lower segments of the duodenum, however, produces a shadow defect like that caused by cancer of the stomach or large bowel, and at least the neoplastic nature of the lesion should be apparent.

Scirrhous and mucoid cancers in the colon produce the same roentgenological manifestations as in the stomach and rarely escape diagnosis. Tuberculous enteritis, with its tendency to affect predominantly the terminal ileac coil and proximal portion of the colon, is usually distinguishable from the resulting asymmetrical and irregular narrowing of the intestinal lumen together with obliteration of the mucosal markings and hyperirritability of the bowel. Likewise, ulcerative colitis can be identified confidently from the fact that the disease obviously has progressed proximalward from the rectum and from the diffuse narrowing and shortening of the lumen, often with local constrictions producing the appearance of a string of sausages. Benign new growths in the colon, like those in the stomach, are usually small, single, or multiple, sometimes numerous, and commonly pedunculated.

Lust, F. J.: Roentgenological Studies of the Mucosa of the Normal Terminal Ileum. *Am. J. Roentgenol.*, 1941, 45: 63.

The normal terminal ileum has not yet been very widely studied roentgenologically. Its mucosal pattern may be demonstrated by administering barium orally or by enemas or covering autopsy specimens with a thin layer of contrast substance. With the oral method, examinations made from three to eight hours after ingestion of the barium invariably yield satisfactory observations. After the barium enema only those cases permitting flow through the ileocecal valve can be observed. Spot film exposures with compression provide good views of the desired loop without overlapping. Studies made revealed parallel and mostly longitudinal mucosal folds of clearcut contour about the thickness of straw. The contrast substance is visible in the crevices of the mucosa, whereas the folds stand out clearly without being covered by barium. The folds converge toward the ileocecal junction.

Further studies of the terminal ileum dealt with the type of filling of this loop. This occurs slowly, the contrast substance slowly trickling along the crevices of the gut. The folds have a wavy appearance and present creeping movements. The waves are shallow and usually occur only on one curvature at a time. Later the bulk of the barium is continuously transported through the ileum into the cecum. The ileal contractions occur ringlike in two places simultaneously, from 2 to 5 cm. apart. These contraction rings should not be confused with mucosal folds; they are much broader than the folds and appear in both curvatures simultaneously. It is emphasized that the careful study of the individual folds is just as important as that of the whole mucosal pattern. ADOLPH HARTUNG, M.D.

Pendergrass, E. P., and Hodes, P. J.: Roentgen Irradiation in the Treatment of Inflammations. *Am. J. Roentgenol.*, 1941, 45: 74.

This communication is an attempt to analyze the results obtained by roentgen irradiation in 527 patients treated for infections in the Department of Radiology of the Hospital of the University of Pennsylvania. It includes cases of bursitis, carbuncle, cellulitis, draining ears, erysipelas, erysipeloid, furuncle, gas gangrene, granuloma telangiectaticum, herpes simplex, parotitis, pneumonia, sinusitis, and verruca vulgaris. As an introduction, various opinions relative to the mechanisms by which irradiation influences inflammation are discussed under the following headings: (a) effect upon bacteria: (b) effect upon normal cellular response to tissue irritants; (c) effect upon normal immunological responses; and (d) effect upon the vascular system. Technique is also given consideration in a general way to indicate the varying factors used.

Each of the conditions treated is discussed in detail and the results obtained by others as well as by the authors are tabulated. The dosages used, number of treatments given and the time interval between them, location and size of areas exposed, other therapeutic measures used simultaneously, and coincidental factors which have a bearing on the therapy are given lengthy consideration. Experimental data in connection with some of the conditions are also included.

In conclusion the authors stress the importance of considering roentgen therapy but one step in the treatment of inflammations. Nature's inherent protective mechanisms are probably of more importance and must be maintained by adequate supportive measures if the best interests of the patient are to be served. ADOLPH HARTUNG, M.D.

Wintz, H.: Roentgen Irradiation of Inflammatory Processes and Its Action Mechanism (Die Roentgenbestrahlung entzuendlicher Prozesse und ihr Wirkungsmechanismus). *Strahlentherapie*, 1940, 68: 3.

Wintz discusses the nature of roentgen irradiation of inflammatory processes and the reasons for its action. He thinks that this action is not a direct effect of the irradiation because, first of all, inflammatory foci located outside of the irradiated field are also favorably influenced; second, the roentgen rays have no direct bactericidal action; third, exact dosage is not necessary to obtain results; and fourth, typical humoral changes, which correspond to those observed in shock, occur after the irradiation.

For instance, after roentgen and radium irradiations, it is easy to demonstrate the immediate occurrence of acidosis followed by alkalosis of the blood, leucopenia, retardation of the coagulation time, decrease in the blood pressure, decrease in the colloid stability, hypoglycemia, and hypervagotony. Wintz gives the following explanation for these symptoms:

The irradiation first causes a disturbance in the equilibrium of the blood colloids, which in turn leads

to conglobation and destruction of the leucocytes; the released protein substances then produce the remaining symptoms of shock. The shock causes an increase in the defense powers of the body and this explains the favorable action produced by the roentgen rays.

The author rejects the usual dosage of from 15 to 20 per cent of the skin erythema dose for inflammations and recommends 80 per cent for abscesses of the sweat glands, 40 per cent for mastitis, and 34 per cent for chronic inflammation of the adnexa.

(T. Antoine). Richard Kemel, M.D.

Pickhan, A.: Practical Results of Researches on the Irradiation Effect on Genes as Applied to Roentgen Therapy and Roentgen Diagnosis. *Radiology*, 1941, 36: 145.

After briefly reviewing the mutation effects produced by different short-wave radiations as determined experimentally by various research workers on drosophilæ, the author presents the following conclusions:

1. In therapy the use of higher doses than those determined experimentally is permissible only in cases in which the possibility of later pregnancy is not to be considered; that is to say, if the patients have passed the menopause or in case of some disease in the treatment of which sterilization as an end-result is of little consequence.

2. In x-ray examination of the region of the sex organs—for example, in fluoroscopy and in roentgenography of the female pelvic organs (in pregnancy and in salpingography)—great attention should be paid to the number of roentgens delivered by these procedures. Attention should be further paid to the fact that in radiogenetics the I.t = K (intensity time equals a constant) law is valid; also in contrast to physiological reaction the time factor is without effect, so that repeated small doses, independent of the time in which they are given, lead to cumulation.

Adolph Hartung, M.D.

Salgado, C., and Ferolla, J.: The Question of Injury of the Embryo Caused by X-Rays (Da questão do dano germinativo provocado pelos raios X). *An. brasil. de ginec.*, 1940, 5: 391.

The question of whether the ovum or embryo is injured by irradiation of the ovaries with roentgen rays is one of great practical interest and one in regard to which there has been a great deal of discussion.

The literature on the question of irradiation of the female and its effect on the progeny is reviewed. Special stress is laid on the work of Mueller on drosophila melanogaster. He irradiated the ova and spermatozoa of these flies and found that mutations resulted in the offspring. By mutation, however, he meant not so much a somatic change in the offspring as a change in the germ plasm of such a nature that alterations were brought about in future generations. The importance of this work in human treatment was admitted.

If it was proved that such irradiation did damage the offspring the temporary sterilization of women by means of roentgen rays would not be justifiable. There are many roentgenologists and gynecologists who feel sure of this and prefer not to use the method. There are others, however, who still believe that there is no reason to avoid its use when it is indicated.

The authors, on the basis of their own experiments on rats, belong to the latter group and think the method is justifiable. They irradiated 5 adult female white rats, using 180 kv. 4 ma., a filter of 0.5 mm. of copper, a focal distance of 30 cm., and fields measuring 6 by 8 cm. The greater part of the bodies of the rats was covered with lead plates, only the region of the ovaries being left exposed. The animals were given doses of from 24 to 60 roentgens. The dose for temporary castration of the rat is from 50 to 60 roentgens; that for the woman is about 200 roentgens.

These rats were bred to the fifth generation and 118 descendants were produced, and in none of the latter were any changes found which were due to roentgen irradiation. The authors think this argues in favor of the harmlessness of the method. However, they do not wish to express a dogmatic opinion on the subject, but merely to record the results of their experiments. Audrey G. Morgan, M.D.

RADIUM

Joint Radiology Committee of the Medical Research Council and the British Empire Cancer Campaign: Medical Uses of Radium. *Brit. J. Radiol.*, 1941, 14: 1.

This summary report on the medical uses of radium has been prepared by the Joint Radiology Committee of the Medical Research Council and the British Empire Cancer Campaign.

Among the many investigations few attract special attention because they not only have a scientific value but offer therapeutic hints.

Gluecksmann has made a detailed quantitative histological analysis of the reaction of squamous-cell and basal-cell carcinoma in man to carefully measured doses of gamma and x-ray radiation. The results showed that the sequence of events is similar to that observed in irradiated normal tissues. Irradiation is followed by a fall in the number of mitotic cells because of a delayed entry of cells into division. Cells attempting division later on break down as described previously for normal irradiated tissues. Inhibition of division is followed by increase in cell size, and by keratinization in some squamous-cell carcinomas. The large cells finally disintegrate while attempting division, and keratinizing cells lose their reproductive powers and disappear as cornified material.

Using chick fibroblast cultures in hanging-drop preparations, Lasnitzki and D. E. Lea have compared the effectiveness per roentgen of radium gamma rays and of three regions of the x-ray spec-

trum, the effective wave lengths being 0.014, 0.017, 0.150, and 0.363 A.U. It was found that the three x-ray wave lengths were, within the accuracy of the experiments, equally effective, but that the gamma rays were less effective by a factor of about 2. There appears to be a real difference in the efficiency, per ionization in tissue, of different wave lengths of radiation.

J. C. Mottram and L. H. Gray report that during the year an investigation has been made upon the relative response of the skin of mice to x-radiation and gamma radiation. Short lengths of the tails of mice were irradiated with x and gamma rays, so that the dose received was the same at all points throughout the irradiated portion of the tail for each irradiation. When thus irradiated with equal doses the skin reactions were found to be markedly different. The ratio of effectiveness for erythema and desquamation was 1.3, and for epilation and exudation 1.6, the x-irradiation having the greater effect. JOSEPH K. NARAT, M.D.

Quimby, E. H.: The Specification of Dosage in Radium Therapy. *Am. J. Roentgenol.*, 1941, 45: 1.

This is the Janeway Lecture of 1940, delivered before the annual meeting of the American Radium Society, on which occasion the author was presented by Zoe Z. Johnston, in behalf of the Society, with a bronze medal, as a reward for "scientific accomplishments of the utmost importance."

The lecture represents an analytical review of the salient facts which have been evolved during the past two decades in the development of useful methods for the specification of radium doses, and to which the author has contributed in no small measure. At the same time, definite suggestions are made, in the hope that, with the aid of the Standardization Committee of the American Radium Society, they may lead to the establishment of a uniform system of practical radium dosimetry.

From the earliest days, the radium dose was stated in terms of the amount of radio-active material employed and the duration of the irradiation, which in fact is the "emitted" dose. The quantity of radiation arriving at the cells to be affected, or the "delivered" dose, may be considerably less, and the actually effective, or "absorbed" dose, may constitute an even smaller quantity. Because of these difficulties with direct physical measurements, various biological dosage methods were devised, most common among them being the observation of the erythema reaction produced in human skin. It must be noted, however, that any such biological dose can be established only as a "standard," and cannot be used as a "measure" of the amount of radiation administered.

In general, there are two aspects of the dosage problem, which depend on whether the radium (or radon) sources are external or interstitial, although sometimes the two may overlap.

The accurate measurement of the dose of external irradiation from radium applicators of many shapes and sizes and at various distances is exceedingly difficult. A more desirable procedure is to calculate the relative intensities by relating, for example, the doses delivered by all applicators to the dose from a point source, and then to test experimentally a few of the results so obtained. If, now, the number of milligram, or millicurie hours required to produce a certain skin erythema with any one of the listed applicators is known, that for any other can be determined by interpolation. The tables worked out at the Memorial Hospital, New York, contain data for some 200 practical applicator sizes and distances. More recently, Sievert, Mayneord, and Patterson, and Parker have published calculations employing more precise mathematical methods but covering smaller ranges of practical applicators.

In interstitial irradiation, both the size of the sources and the distances to be considered become very much smaller, so that the measurement with the minutest ionization chambers available becomes even less accurate than in the external irradiation. However, here too, good use can be made of the comparison of relative intensities. Failla and his coworkers in a long series of experiments actually determined the values of such intensities by making use of three different methods, such as determining: the relation of milligram, or millicurie, hours exposure to the radius of necrotic tissue produced around the implanted source in the muscles of rabbits; the relation of the amount of radiation to the radius of bleaching around a similarly imbedded source in butter; and, finally, the relation of a beeswax surrounded radiation source to the intensity of human skin erythema. On the other hand, intensity curves were calculated in a manner similar to that employed for external sources by Sievert, Paterson, and Parker, Laurence, and the author herself, due allowance being made for the tissue-absorption factor. From such curves, experimental or theoretical, it is possible to determine the relative doses for various given practical situations, if the implant is a seed or very small needle and is assumed to behave essentially as a point source. If multiple implants are used, it appears best from the point of view of simplification of the calculations to determine the minimum lethal dose that can be delivered to any particular point of the diseased region and to plot the dosage curves accordingly.

During the last few years attempts have been made to express the radium dose, both for external and interstitial application, in the absolute roentgen unit. The author, after carefully analyzing the various physical factors which influence the accurate realization of this unit for the gamma rays of radium (in contra-distinction to the roentgen rays), states that if such a dosage scheme is to be adopted, three things must be taken into consideration. First, any value for the roentgen equivalent of the milligram hour must be regarded as subject to correction although this probably amounts to not more than a few per cent. Second, this value is correct only for points in the tissue surrounded by at least 4 mm. of

organic material (the thickness of the measuring ionization chamber wall). In other words, the value is correct for interstitial implants, wax molds or other similar surface applicators, but is not correct for the skin in teleradium therapy, unless this is deliberately covered by a 4-mm. sheet of bakelite, celluloid, or rubber. Third, and most important, it must be acknowledged that while these gamma-ray roentgens produce the same number of ions per unit mass of air as the standard roentgen-ray roentgens, the same effect is not necessarily true for living tissues, especially the skin. Therefore, it is not correct to add roentgen-ray roentgens and gamma-ray roentgens and expect the sum to express tissue dose. To avoid confusion in this respect, the Standardization Committee of the American Radium Society advises that the symbol of γ be used as a subscript to the latter roentgen whenever expressing gamma-ray dosage (r_γ).

By making allowance for the various factors, the value of 8.56 may be taken as the corresponding number of roentgens per milligram hour at 1 cm. distance from a point source of radium with a filter of 0.5 mm. of platinum. The statement of the output of a radium source in terms of this unit may be applied directly for the expression of the radium dosage, as done in the system employed by Paterson and Parker, and by Laurence. Or, the physical dose may be converted into a biological dose by making use of a system based on the skin erythema, as practiced at Memorial Hospital. On the basis of numerous clinical observations, it was established that the amount of gamma radiation necessary to produce an erythema of the skin corresponds to an average of 1,060 roentgens. Thus, broadly, 1,000 is a satisfactory conversion factor for transforming erythema doses into roentgens and *vice versa*.

In conclusion, the author cautions against the indiscriminate use of the roentgen as a dosage unit. This caution applies not only to the gamma rays but to the roentgen rays of various qualities as well. For example, the difference between the number of 200 kv. roentgen-ray roentgens and 100 kv. roentgen-ray roentgens to produce a skin erythema is considerably greater than that between 200 kv. roentgen rays and gamma rays. Furthermore, it was shown by the author that if a combination of gamma and roentgen rays is used in equal parts, the total number of roentgens which may be administered to produce a certain erythema is greater than with either of the rays alone. Therefore, the desire to simplify the dosage must not be allowed to lead to inconsistencies or gross inaccuracies.

T. Leucutia, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Levinson, S. O., and Wolf, A. M.: Human Serum; Its Application in Medicine. *Med. Clin. North Am.*, 1941, 25: 219.

The authors recount briefly the technique for preparation and pooling of immune sera as it is carried out in the Serum Center.

In scarlet fever the use of convalescent serum has been about 97 per cent successful in preventing the disease. Its use as a therapeutic measure is also successful in shortening the febrile period and lessening the complications. Its use in the treatment of the complications, while not so dramatic, is believed by the authors to be beneficial. The use of convalescent serum in other types of streptococcus infections is discussed and illustrative cases are recounted to show some benefit.

Measles may be prevented by the intramuscular administration of from 5 to 7.5 c.cm. of convalescent serum within four days after exposure. The disease may be ameliorated by the administration of serum after this time even if given in the preëruptive stage.

Although it is very difficult to evaluate the action accurately, the authors believe convalescent serum checks the progression of paralysis and hastens recovery in poliomyelitis.

In mumps the use of serum is still in some doubt but evidence of lessened complications appears satisfactory.

The value of serum in chicken pox and pertussis is still unknown.

The use of normal human serum in severe hemorrhage, shock, and burns is mentioned.

THOMAS C. DOUGLASS, M.D.

Lenormant, H.: The Nature of Tetanus Toxin (Sur la nature de la toxine tétanique). *Presse méd.*, Par., 1940, 48: 1049.

In a review of various studies on the nature of tetanus toxin, Lenormant points out that, like the toxin of diphtheria and botulism, it is an exotoxin. Exotoxins differ from endotoxins in several important particulars. They are extracted by [illegible]le filtration from cultures of the organism [illegible] fluid medium; they reproduce the symptoms of the disease in very small doses; they are more sensitive to heat than endotoxins and their antigenic power is greater. Their nature is not as well understood as that of the endotoxins, although they have been studied by many investigators.

Investigations of tetanus toxin indicate that it resembles a diastase in its composition. It has been shown that this toxin consists of: (1) a colloidal substance of a protein nature, a true apotoxin, the function of which resembles that of the corresponding portion of a diastase, and with which the antigenic power is associated; and (2) an active substance, the cotoxin. These two elements are united in a chemical union in the same way as a codiastase and an apodiastase. This concept of the nature of tetanus toxin has not as yet, been definitely established, the author admits, but on the other hand no facts have been discovered that invalidate this concept.

On this basis it may be considered that formol, through the action of its aldehyde, acts upon the apotoxin (the protein substance) in such a way as to dissociate it from the cotoxin but not to destroy its antigenic power; the protein molecule is stabilized and becomes more resistant. By more intense action, formol may diminish and ultimately destroy the antigenic power.

ALICE M. MEYERS.

Wyatt, T. E., and Buchholz, R. R.: Amebiasis Cutis. *Ann. Surg.*, 1941, 113: 140.

Two patients with amebiasis cutis encountered in the Vanderbilt University Hospital are presented, 1 of whom recovered. The condition is admittedly rare, only 28 cases being collected from the literature. Each is presented in this article in synopsis form. Fifteen of the patients recovered, 11 died, and 2 were not followed up. This skin condition always occurs with associated visceral lesions, usually in markedly malnourished individuals.

The diagnosis rests first upon suspicion of the disease, and secondly upon the gross pathological picture of a rapidly spreading ulcerative process with overhanging margins, advancing "halo" of erythema, and a base bathed in a viscid pus. Microscopically the picture is one of tissue lysis with little inflammatory reaction. The margin of the ulceration reveals the presence of the amœba interstitially, often when the exudate is free of the organism. Secondary infection of the ulcer may complicate and distort the picture.

To be effective, treatment must be early and adequate. The authors stress the point that with the above pathological picture, it is justifiable to administer emetine even in the absence of the demonstration of the amœba. Next in importance is thorough débridement of the ulcer with adequate drainage and dakinization. Skin grafts should be applied as soon as the granulating areas permit.

STANLEY ROBBINS, M.D.

André-Thomas: Pain of Cyclothymic States; A Case with Brachial Pain (Les algies des états cyclothymiques; À propos d'une algie brachiale). *Presse méd.*, Par., 1940, 48: 905.

Pain often indicates the beginning of an organic disease of the nervous system. The later accompaniment of objective signs indicates the location and nature of the disease or of the lesion. There are many other conditions in which the patient experiences vague or transitory pains which are difficult to

localize. The neurologist frequently believes that in these patients there is no organic trouble in the nervous system and sends them to the psychiatrist.

The author cites the case of a thirty-year-old woman whose general health was good but who complained of continuous, sometimes exasperating pain in the right upper limb. This followed severe alveolar neuralgia which was believed to be due to two infected teeth, requiring denervation. It was not possible to obtain from the patient a description of the character of the pain in the right upper extremity. This pain was so troublesome that it eventually led her into a melancholic depressive state. Physical examination revealed no abnormalities.

The author states that pains similar to that of the patient cited have been considered to be of vascular or sympathetic origin. Sympathetic pains are associated either with an organic lesion or with a modification in the size of the limb and circulatory and thermic changes. In the author's case there seemed to be no organic lesion of the sympathetic centers and pathways. The objective difficulties, since they could not be related to a purely mechanical cause, seemed to justify the supposition that the sympathetic system was involved. However, this interpretation must be reserved, since there were no anatomical changes. The author believes that the sympathetic system might have been responsible for the condition but this probability was not great.

Cyclothymic (manic-depressive) states are characterized not only by alterations in personality and character but also by modification in functions or organs. In many patients who are less deeply affected emotionally, visceral symptoms are evident. Sensitive symptoms including headache, tender spine, epigastric pain, and vague and diffuse arthritis are predominant in many cases. Exaggerated cenesthesia is constantly noted. In many patients the symptoms are localized in different organs with each attack. In plastic forms of cyclothymic states, in which the patient retains confidence in his physician, pain can be alleviated by drugs and by reassurance from the physician.

MICHAEL DEBAKEY, M.D.

Dahlberg, G.: On the Heredity of Malignant Tumors. *Upsala Läkaref. Förh.*, 1940, 46: 21.

The development of tumors may be compared to vegetative reproduction. In certain low-grade, multicellular animals reproduction sometimes occurs in the following way:

Some one cell in the animal returns to a primary, embryonic stage. A cell or group of cells begins to divide with enormous rapidity. From among the descendants a new individual is differentiated. Vegetative reproduction occurs above all in adult individuals. Evidently it has a special tendency to occur after a certain number of cell generations, and this involves a lapse of time. At present we can hardly decide whether to lay a particular stress on the number of cell segmentations, or on the time which has elapsed.

If we look at the tumor problem against the background of vegetative reproduction, we can recognize striking analogies and see possibilities of explaining the most important features of tumor tissue. In both cases we are dealing with formations of an autonomous character. To a certain extent they grow as parasites on the mother animal. To a certain extent the cells of both share embryonic characteristics, but in the non-malignant tumors this is not so marked, and the tendency to growth is less strong. The tendency of the tumors to occur especially in older individuals is also analogous to phenomena of the vegetative reproduction, as is the fact that tumors may develop spontaneously. However, it should be emphasized that, if we interpret the formation of tumors by analogy with vegetative reproduction, we must not carry the analogy too far. It is evident that tumor formation is not merely a reproductive process. The author's view merely implies that chemical and physical changes involved in tumor formation resemble chemical and physical changes involved in vegetative reproduction, in so far as they occur under similar conditions. It implies nothing about the nature of these changes.

It is a known fact that environmental agencies and stimuli in particular may bring about the development of malignant growths. If an environmental agent is not the cause of the development of tumors, the cause must be sought among hereditary factors. No third possibility exists. The suggestion advanced implies two things: (a) a rudimentary tendency toward vegetative reproduction is inherited by every individual of the species, (b) practically every person who lives long enough ought to develop a malignant tumor. Some people develop cancer after comparatively few cell divisions at a younger age, others develop the disease only after much more numerous cell divisions and at a more advanced age, while a third group may develop malignant tumors only if exposed to very strong irritation, which itself provokes cleavage of cells.

If this is so, the prospect of proving that malignant tumors are hereditarily determined would be greater if we select individuals who have died of a tumor at a younger age than if we chose only persons who have died of cancer or sarcoma in old age. From this point of view a person who has died of cancer at the age of ninety years must have a comparatively weak tendency to form tumors. Hence we should not expect his relatives to show a significantly higher frequency of cancer than other people.

To test this hypothesis the author collected data pertaining to this subject from the files of three insurance companies. The first step was to sort out a group of persons who have themselves died of cancer but were offsprings of parents who had not died of cancer. For the sake of simplicity this group is called the normal group. The remaining part of the material embraces persons who have died of cancer and were offsprings of parents one or both of whom had also died of cancer. This group is called the cancer group.

TABLE I.—DEATHS FROM CANCER

	Number	Average	Error of mean
Series A. Persons having died of cancer but whose parents have *not* died of cancer	1,837	54.26	0.30
Persons having died of cancer and whose parents have *also died* of cancer	104	55.03	1.00
Persons whose parents have died of cancer below the age of 60	58	51.83	1.20
Persons whose parents have died of cancer above the age of 60	46	59.07	1.50
Series B. Persons having died of cancer but whose parents have *not* died of cancer	176	57.84	0.85
Persons having died of cancer and whose parents have *also died* of cancer	169	55.51	0.93
Persons whose parents have died of cancer below the age of 60	96	53.28	1.24
Persons whose parents have died of cancer above the age of 60	73	55.95	1.12
Series A and B. Persons having died of cancer but whose parents have *not* died of cancer	2,013	54.57	0.29
Persons having died of cancer and whose parents have *also died* of cancer	273	55.33	0.69
Persons whose parents have died of cancer below the age of 60	154	52.73	0.91
Persons whose parents have died of cancer above the age of 60	119	57.06	0.94

If we first compare the normal group with the cancer group, the differences are not statistically significant. In series A (embracing material collected by the author), the normal group happens to show a lower death age. In series B (embracing the material collected by the Association of Directors), the normal group shows a higher death age. In adding the figures of both series, the normal group shows a somewhat lower age of death than the total cancer group. The fact that the materials agree within the limits of error suggests that there is a real difference because there is a source of error which tends to lower the value of the normal group below that of the cancer group. If we examine the cancer group after dividing it with respect to parental death-age, in the material as a whole we find a difference between the two groups amounting to 4.33 ± 1.30. This difference is more than three times the standard error and is therefore significant.

The author's method of investigation of the hereditary factors, although costly and time-consuming deserves attention but has to be tested on a larger material to allow a definite conclusion.

JOSEPH K. NARAT, M.D.

Des Ligneris, M. J. A.: Precancer and Carcinogenesis. *Am. J. Cancer*, 1940, 40: 1.

The question whether or not there must always be a precancerous stage, recognizable as such by histological or clinical examination, is not merely academic; it is of paramount practical importance. The possibility of early treatment is naturally bound up with that of early diagnosis. If it can be shown that cancer is always preceded by a precancerous condition, and if this latter condition can be diagnosed as such, then the question of early cancer diagnosis naturally becomes a question of diagnosing precancerous conditions; at the same time the general prognosis must be enormously improved. If, on the other hand, it is shown that only a comparatively small number of cancers are preceded by a precancerous condition, that in the majority of instances such a condition cannot be diagnosed, and that of the diagnosable cases only a very small proportion lead eventually to cancer, the term precancer loses its importance and the chances of treatment suffer accordingly.

The author describes four groups of experiments as follows:

1. The development of sarcomas and allied tumors in rats and mice treated with cancer-producing chemicals.
2. The production of benign and malignant skin tumors in mice.
3. The development in stages of fowl sarcomas after the injection of tumor filtrates.
4. The development of spontaneous mammary carcinoma in mice of a tumor-susceptible strain.

In rats and mice treated with carcinogenic chemicals (3:4-benzpyrene and methylcholanthrene) the development of intraperitoneal and subcutaneous sarcomas follows a fairly long preparatory, precancerous period. Different types of tumors are produced according to the tissue on which the carcinogens act. Many of the tumors thus obtained are transmissible to other animals of the same strain for a limited number of generations.

The production of skin tumors in mice with these same cancer-producing hydrocarbons is always preceded by a precancerous state, papillomatosis. When, as a consequence of the application of the cancer-producing chemical, the cell has reached a certain stage of constitutional alteration (though this stage may not necessarily be accompanied by microscopically recognizable changes), cancerization may proceed without the aid of further specific carcinogenic action. Non-specific irritation (scalding) has at this stage the same effect as the specific action by a cancer-producing compound. On the other hand, such specific stimulation cannot be replaced, in early stages, by non-specific stimulation (scalding). No increase in the rate or frequency of cancerization is obtained by the simultaneous application of a specific and a non-specific stimulant.

When a filtrate of a Rous tumor is injected intramuscularly, subcutaneously, or intracutaneously into a new fowl, local tumors appear, which have the same appearance whatever the site of injection. The cells from which the tumor develops are the blood and tissue macrophages and fibroblasts of undifferentiated type. The Rous sarcoma is thus a malignant tumor of the reticulo-endothelial system. The transformation of a normal cell into a tumor cell

under these conditions occurs suddenly, there being no precancerous state.

The author also describes the development of spontaneous mammary carcinoma in mice. No definite precancerous state could be found in the cancer-susceptible strain of mice. The tumors developing in the mammary gland were either of the adenocarcinoma or of the carcinoma simplex type. In some tumors the cells were very small and the tumor resembled a sarcoma or lymphosarcoma; but even in these cases some portions of the tumor contained rudimentary alveoli and thus showed the transition from the more differentiated adenocarcinoma to the more anaplastic small-cell carcinoma simplex. In no tumor was there any considerable amount of connective tissue; several tumors were partly cystic.

The main results of investigations reported in the literature dealing with the relationship between mammary cancers and other tumors, on the one hand, and hormones, more especially sex hormones, on the other hand, are summarized as follows:

The susceptibility of certain mice to the development of mammary cancer is due in the first instance to a hereditary character of the cells involved. According to whether these take up large or small quantities of the hormone (estrin), which forms their natural stimulant, breast cancer will develop more or less frequently, there being no difference in this respect between males and females. In normal life males fail to have breast cancer simply because of the absence of estrin, not because the male breast cells are less liable to become cancerous than the female breast cells. Males given sufficient estrin for a sufficiently long period invariably develop breast cancer if they belong to a cancer-susceptible strain; in a cancer-resistant strain, only a few will develop cancer, but after a much longer period. This susceptibility of the breast cells to cancer is a purely local tissue particularity. There is no convincing evidence that it bears a relationship to particularities of the sexual cycle or to other manifestations of sexual life. Cancer production in the breasts of susceptible mice depends on the activity of the breasts; thus frequent breeding and lactation bring about an increase of cancer incidence.

If one tries to apply the results of all the experiments (the author's as well as those of others) described in the article to human cancer, it seems justified to draw a number of important conclusions:

The rôle of heredity in the occurrence of cancer in man has been much discussed. In the majority of cases, evidence in favor of hereditary susceptibility is rather vague and most examples would not survive the criticism of a trained statistician. On the other hand, it must be said that it is practically impossible to trace the hereditary factor in human cancer back for an adequate number of generations. Human breeding is so haphazard that it is impossible to obtain anything like the clear evidence procured from mouse breeding. There are, nevertheless, a few selected examples of familial cancer, as well as statistical studies of small stable populations, as in Norway, which suggest that in human cancer heredity may play an important rôle. Such predisposition may be compared with cancer-susceptibility in mice. In these cases we would not expect to see much of a precancerous condition. There is every reason to believe that in a strongly predisposed tissue cancerization occurs suddenly, with little warning.

There are other cases of neoplasia in man in which the hereditary factor tends to create, not ready-made cancer, but either a condition of benign tumor formation, such as rectal and colonic papillomatosis, or a semi-inflammatory, semi-neoplastic condition such as xeroderma pigmentosum. In the former case ordinary irritation, such as fecal stasis, may transform the papillomatosis into a carcinomatous condition; in the latter, exposure to sunlight may lead to the development of epithelioma.

The various forms of industrial cancer, such as the lung cancer of the radium miners in Czechoslovakia, paraffin and soot cancer, aniline cancer, x-ray cancer, and others, occur in individuals who otherwise would probably not have had spontaneous cancer, at least not in the particular organ affected.

In considering the great bulk of "spontaneous" cancer in man, in which the responsible factor has not been found, we must look for precancerous conditions. It seems probable, however, that no exact definition can be given, at least in our present state of knowledge, of what constitutes a precancerous condition. It is probable that any chronic condition of irritation may occasionally lead to cancer, some lesions more easily than others, and in all cases a constitutional factor undoubtedly plays an all important rôle. Our task then is to remove or to heal any potential precancer before cancerization sets in. However, the fight against cancer may go further than that. In view of the fact that the majority of precancerous conditions will probably, for a long time to come, escape our methods of detection, we must aim at strengthening the resistance of the organism generally; if the organism can overcome an infection before it becomes chronic, there will probably be no cancer. Thus we may conclude by saying that, however unsatisfactory our methods of detecting precancerous conditions may be, we must combat the onset of precancerosis by all the methods which tend to improve the health of the organism.

SAMUEL H. KLEIN, M.D.